FEBRUARY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Original Communications

THE INFLUENCE OF DIET ON THE BONE SYSTEM WITH SPECIAL REFERENCE TO THE ALVEOLAR PROCESS AND THE LABYRINTHINE CAPSULE*

By HERMANN BECKS, M.D., D.D.S., and MORITZ WEBER, M.D.,
San Francisco, Calif.

THE nutritional experiments of the last decade have shown that chronic diseases of the organism can be produced by certain diets; therefore, certain bone diseases can also be experimentally produced. The diseases of the bone tissue based on a chronic disturbance of the metabolism have been described as osteopathies (osteoses). Diseases developing through calcium deficiency have always been of special interest and have been called, in general, "calciprivative osteopathies." Research on rickets has shown that the vitamin D content of the food is a deciding factor in the development of calciprivative osteopathies.

It is known that in paradentoses (pyorrhea), we are dealing with a chronic disease of the alveolar process. The progress of research in paradentosis during the last few years (Arbeitsgemeinschaft für Paradentosenforschung, in Germany) has shown that it is possible to trace some of these chronic bone diseases to a chronic metabolic disturbance of the general system (genuine paradentoses, Becks). Biochemical examinations of patients with genuine paradentosis have shown furthermore that a chronic disturbance of the mineral metabolism is

*From the George Williams Hooper Foundation for Medical Research, and the College of Dentistry, University of California.

*Aided by grants from the Carnegie Corporation, the Research Commission of the American Dental Association, the California State Dental Association and the John C. and Edward Coleman Memorial Fund.

*Portions of this paper have been presented before the American Otological Society, Inc., Swampscott, Mass., May 20, 1930; California State Dental Association, Sacramento, Calif., May 21, 1930, and the Section on Physiology, Histology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 21, 1930.

present in certain cases. Therefore, the question arises as to whether these cases of genuine paradentoses are histologically related to calciprivative osteopathies. In order to bring these questions closer to a solution, a large number of diet experiments were undertaken by the Stomatological Research Group of the University of California, under the immediate direction of Dr. Agnes Fay Morgan, professor of household science, with the collaboration of her associates. In addition to the two factors, calcium and Vitamin D, it has been possible to place these artificially produced systemic diseases in the group of osteoses and to determine whether or not they duplicate the histopathologic changes of rickets. Furthermore, the labyrinthine capsule has been examined (Weber), in order to utilize the extremely valuable material in solving problems related to the experimental production of otosclerosis. Weekly clinical examinations of dogs have been made (W. Fleming[1]).

During the lifetime of the experimen-

Fig. 1.—Longitudinal section of right tibia, distal, outside; resorption cavities underneath the periosteum. (Dog 46, normal salt mixture with vitamin D.) (Spec. 1919 A, embedded in parlodion, stained with thionin-picric acid: Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 75 cm.; ×144.)

special attention was paid to the reaction of the foods, which is supposed to play an important rôle (Jones).

In order to determine to what extent the tooth changes are the expression of systemic disease, the whole bone system and the organs have been examined (Weber), as well as the tooth system and the jaws (Becks). From these histologic examinations of the bone system, tal animals, extensive biochemical examinations of the body fluids were made (Morgan[2]). By means of this joint

1. A complete report (by Hermann Becks ing the time they were under experimentation, of these dogs, especially the mouth tissue, during the time they were under experimentation will be published later.

2. Dr. Morgan will report separately on her biochemical research.

examination (histologic and biochemical) of the same material, it should be possible to draw conclusions which may be of importance in the study of diseases whose etiology is still obscure.

THE PROBLEM

The present problem is concerned with the following: In what way is the bone system of dogs affected by a combination of three factors (calcium deficiency, vitamin D deficiency [cod liver oil] and the reaction of food) and what special pathologic changes occur in the alveolar process and the labyrinthine capsule?

Fig. 2.—Cross-section of right radius, diaphysis, outside; new formation of fibroblastic osteoid and fiber bone following resorption (cementum line); osteoblasts in epithelial arrangement. (Dog 46, normal salt mixture with vitamin D.) (Spec. 1918 D, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm., eyepiece 6x; extension of camera 46 cm.; ×132.5)

A. METHOD AND MATERIAL

Experimental Animals. — 1. Animal species: The publications of early investigators (Mellanby, Simonton, Jones, Jaffe and Bodansky) state that the dog seems most nearly to fulfil the requirements for such experiments. More comparable results might have been obtained by using monkeys instead of dogs because of their similarity to human beings (conditions of articulation, digestive juices, etc.) The choice of the material did not rest with the authors. The work was done in conjunction with certain problems in biochemistry the study of which had already been commenced when we began our work. On the other hand, it is almost impossible to obtain monkeys young enough for this type of experiment.

2. Number of dogs: In order to obtain standard values, it was necessary to begin this experiment with a large number of animals because of the mortality

rate during the experiments. Thirty-three dogs were put under experiment, but owing to certain conditions, eight of these animals could not be considered and eleven of the remainder died from intercurrent diseases during the experiment. Material from these eleven animals was utilized to some extent because, for several months preceding death, they had been under experiment and in a healthy

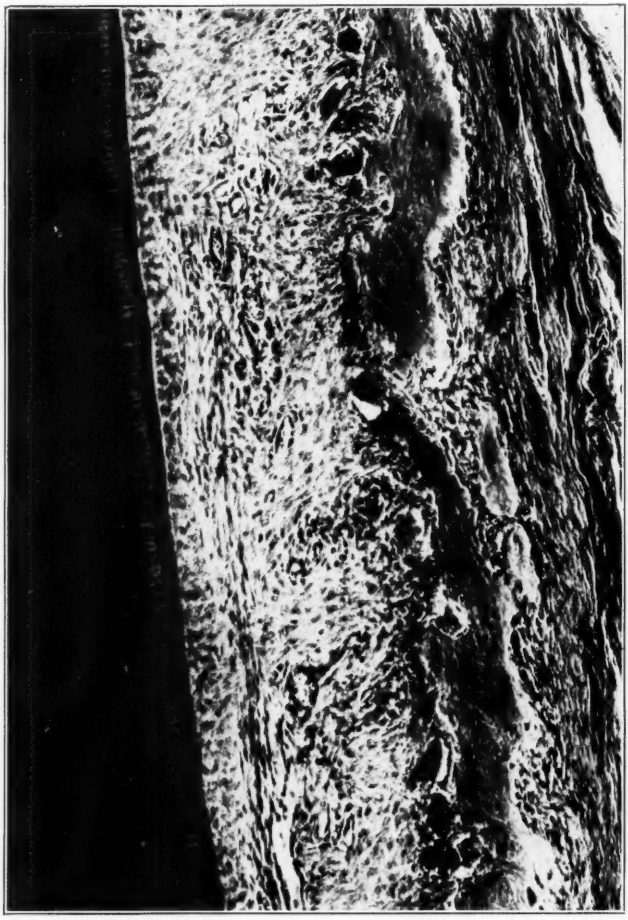

Fig. 3.—Resorption by giant cells of distal alveolar process, osteoid margin and peridental membrane as the expression of slight osteoporosis. (Dog 46, normal salt mixture with vitamin D.) (Spec. 1925, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm., eyepiece 4x; extension of camera 80 cm.; ×153.6.)

condition, death following a very brief illness.

3. Type and sex: Two types of dogs were used in these experiments, setters and fox terriers. Of the twenty-five dogs reported on, two-thirds were male and one-third, female.

4. Age: In general, the dogs were put on experimental diets when about 6 weeks old, or at the end of the weaning period.

6. General conditions: All animals during the period of the experiment lived under identical local conditions. It is unfortunate that the cages used were comparatively poorly lighted, but runways were connected with these cages so that the animals had daily access to outdoor conditions.

Diet.—Only purified diets were used, the chemical compositions of which were

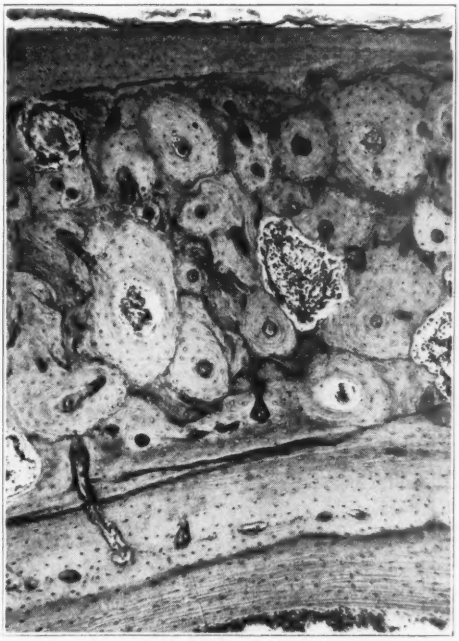

Fig. 4.—Cross-section of left ulna, diaphysis; cortex showing resorption cavities containing reticulated marrow, hemorrhages and a few giant cells, with a very narrow osteoid margin. (Dog 20, normal salt mixture with vitamin D.) (Spec. 722, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 6x; extension of camera 27 cm.; ×77.7.)

The time they were kept on these diets averaged five and one-half months.

5. Time of the year: The period of experimentation for these animals is shown in Table 4.

known exactly. Because of this fact, the results of the histologic as well as of the biochemical analyses are of especial value. Furthermore, it is possible to duplicate these experiments. Starting from a basal

TABLE 1. — SALT MIXTURES

Normal Salt Mixture (Osborne and Mendel) Diets 4 and 4a		Low Calcium Salt Mixture (Osborne, Mendel and Park) Diets 11 and 11a	
	Gm.		Gm.
$CaCO_3$	134.8	$MgCO_3$	48.4
$MgCO_3$	24.2	Na_2CO_3	68.4
$NaCO_3$	34.2	K_2CO_3	241.0
K_2CO_3	141.3	H_3PO_4	117.0 (137.6 c.c.) of 85 per cent H_3PO_4
H_3PO_4	103.2	HC1	53.4 (148.3 c.c.) of 36 per cent HC1
HC1	53.4	H_2SO_4	9.2 (9.6 c.c.) of 95 per cent H_2SO_4
Citric acid	111.1	Citric acid plus H_2O	53.0
Ferric citrate	6.3400	Ferric citrate plus 1½ H_2O	6.34
			9.2000
K J	0.0200	K J	53.0000
$MnSO_4$	0.0790	$MnSO_4$	6.3400
NaF	0.2480	NaF	0.0200
$K_2 A1_2 (SO_4)_4$	0.0245	$K_2 A1_2 (SO_4)_4$	0.0790

TABLE 2.—DETAILS OF COMPOSITION OF DIETS, WITH NORMAL AND LOW CALCIUM SALT MIXTURE, WITH AND WITHOUT COD LIVER OIL*

Normal Salt Mixture				Low Calcium Salt Mixture			
With Cod Liver Oil Vitamin D		Without Cod Liver Oil No Vitamin D		With Cod Liver Oil Vitamin D		Without Cod Liver Oil No Vitamin D	
Diet 4		Diet 4a		Diet 11		Diet 11a	
	Gm.		Gm.		Gm.		Gm.
Casein	19.2	Casein	19.2	Casein	19.2	Casein	19.2
Sugar	21.3	Sugar	21.3	Sugar	21.3	Sugar	21.3
Yeast†	0.6	Yeast	0.6	Yeast	0.6	Yeast	0.6
Lemon juice‡	3.0	Lemon juice	3.0	Lemon juice	3.0	Lemon juice	3.0
Dried liver	1.0	Dried liver	1.0	Agar	0.4	Agar	0.4
Normal salt mixture (Table 1)	1.0	Normal salt mixture (Table 1)	1.0	Low calcium salt mixture (Table 1)	1.5	Low calcium salt mixture (Table 1)	1.5
Crisco**	5.0	Crisco	2.4	Crisco	5.0	Crisco	2.4
		Butter fat§	3.6			Butter fat	3.6
Cod liver oil#	1.0	No cod liver oil		Cod liver oil	1.0	No cod liver oil	

*The values are expressed in grams per kilogram of body weight of dogs.

†Yeast is rich in vitamin B.

‡Lemon juice is rich in vitamin C.

**Crisco does not contain vitamin D.

§Butterfat is rich in vitamin A.

#Cod liver oil is rich in vitamin D.

diet, three factors in the foods have been variable: (1) the salt mixture, (2) the content of vitamin D (cod liver oil) and (3) the reaction.

1. Salt mixture: Two different salt mixtures were used: (*a*) normal and (*b*) with low calcium values. The so-called normal salt mixture was prepared according to Osborne and Mendel. All diets with normal salt mixture are indicated by the numbers 4 and 4a in this paper. The low calcium mixture was prepared according to Osborne, Mendel and Park. All low calcium diets are indicated in this paper by the numbers 11 and 11a. The animals fed with normal salt mixture therefore represent the controls as to the salt mixture for those fed a low calcium diet. In order that a complete picture of the whole experiment may be more easily obtained, the salt mixtures used in this work are given in Table 1.

2. The vitamin D content (cod liver oil): The diets with a normal salt mixture and also with a low calcium salt mixture were further modified by the addition of cod liver oil in one group (diets 4 and 11) and the exclusion of cod liver oil (vitamin D) in another group (diets 4a and 11a); i. e., the animals fed diet 4 represent the controls for those fed diet 4a, and those fed diet 11 are the controls for those fed diet 11a. Thus, the foregoing data represent four different diets, which are shown in Table 2. The exact details of the composition of these diets are also given.

From Table 2, it is obvious that all diets were rich in vitamins A, B and C. In those diets from which vitamin D has been omitted (4a and 11a), the lack of fat was supplied by the addition of butter fat rich in vitamin A.

3. The reaction: In every diet mentioned in Table 2, three different modifications of the reaction of the diet (acid, neutral and basic) were used.

(*a*) Acid reaction. In order to make the diet acid, 0.08 gm. of sodium chlorid and 0.045 gm. of ammonium chlorid were added. The doses were so regulated that the p_H of the urine was kept below 7.0.

TABLE 3. — DISTRIBUTION OF TWENTY-FIVE DOGS AS TO DIFFERENT DIETS

	Basal Diet											
	Normal Salt Mixture						Low Calcium Salt Mixture					
	Cod Liver Oil (Vitamin D)			No Cod Liver Oil (No Vitamin D)			Cod Liver Oil (Vitamin D)			No Cod Liver Oil (No Vitamin D)		
	Diet 4			Diet 4a			Diet 11			Diet 11a		
Reaction of food.....	Acid	Neut.	Basic	Acid	Neut.	Basic	Acid	Neut.	Basic	Acid	Neut.	Basic
Number of dogs	21 27* 46	20† 48	19* 28* 44	41	26 43	24 30 42	82*	61*	76	58* 60 73*	84* 85†	62† 59 83

*Not included either because of insufficient time on diet or death from intercurrent disease.
†Death due to intercurrent disease.

TABLE 4.—DATA ON EXPERIMENTAL ANIMALS*

Dog No.	Age at Beginning of Experiment Months	Date of Birth	Date of Death	Preliminary Diet I		Preliminary Diet II		Main Diet		Survival in Months	Months on Main Diet
				Diet	Months	Diet	Months	Diet	Months		
20	1	Sept. 28, '27	March 19, '28	1	Nov. 1-Dec. 23 $1\frac{3}{4}$	3	Dec. 23-Jan. 20 1	4	Jan. 20-March 19 2	$4\frac{3}{4}$	2 (4)
21	1	Sept. 28, '27	June 13, '28	1	Nov. 1-Dec. 23 $1\frac{3}{4}$	2	Dec. 23-Jan. 20 1	4	Jan. 20-June 13 $4\frac{3}{4}$	$7\frac{1}{2}$	$4\frac{3}{4}$ (4)
24	$1\frac{1}{4}$	Oct. 8, '27	June 13, '28	1a	Nov. 10-Dec. 23 $1\frac{1}{2}$	3a	Dec. 23-Jan. 20 1	4a	Jan. 20-June 13 $4\frac{3}{4}$	$7\frac{1}{4}$	$4\frac{3}{4}$ (4)
26	$1\frac{1}{2}$	Feb. 3, '28	June 13, '28	1a	Nov. 30-Dec. 23 $\frac{3}{4}$	3a	Dec. 23-Jan. 20 1	4a	Jan. 20-June 13 $4\frac{3}{4}$	$6\frac{1}{2}$	$4\frac{3}{4}$ (4a)
30	4	?	June 13, '28					4a	Dec. 1-June 13 $6\frac{1}{2}$	6	6 (4a)
41	$1\frac{1}{4}$	Feb. 3, '28	Dec. 4, '28	4a	March 12-June 26 $3\frac{1}{2}$	8	June 26-Aug. 1 $1\frac{1}{4}$	4a	Aug. 1-Dec. 4 4	9	$7\frac{3}{4}$ (4a)
42	$1\frac{1}{4}$	Feb. 3, '28	Dec. 4, '28	4a	March 12-June 26 $3\frac{1}{2}$	8	June 26-Aug. 1 $1\frac{1}{4}$	4a	Aug. 1-Dec. 4 4	9	$7\frac{3}{4}$ (4a)

43	1¼	Feb. 3, '28	Dec. 4, '28	4a	March 12-June 26 3½	8	June 26-Aug. 1 1¼	4a	Aug. 1-Dec. 4 4	9	7½ (4a)
44	1¼	Feb. 3, '28	Dec. 12, '28	4	March 12-June 26 3½	8a	June 26-Aug. 1 1¼	4	Aug. 1-Dec. 12 4½	9¼	8 (4)
46	1¼	Feb. 3, '28	Dec. 12, '28	4	March 12-June 26 3½	8a	June 26-Aug. 1 1¼	4	Aug. 1-Dec. 12 4½	9¼	8 (4)
48	1¼	Feb. 3, '28	Dec. 12, '28	4	March 12-June 26 3½	8a	June 26-Aug. 1 1¼	4	Aug. 1-Dec. 12 4½	9¼	8 (4)
59	1¼	March 9, '28	Nov. 1, '28	6	April 16-May 23 1¼			11	May23-Nov. 1 5¼	6½	5¼ (11)
60	1¼	March 9, '28	Nov. 1, '28	6	April 16-May 23 1¼			11	May23-Nov. 1 5¼	6½	5¼ (11)
62	1¾	?	May 27, '28					11	Throughout life	1½	1½ (11)
76	1¼	March 23, '28	Nov. 1, '28	11a	May 7-Aug. 1 2¾			11	Aug. 1-Nov. 1 3	5¾	3 (11)
83	1½	June 18, '28	March 4, '29					11	Throughout life	8½	8½ (11)
85	1½	June 18, '28	Jan. 20, '29					11	Throughout life	7	7 (11)

*Dogs 21, 24, 41, 59, 60, 83 and 85 were females; the remainder, males. Dogs 20, 62 and 85 died; the remainder were killed. Dogs 41, 42, 43, 44, 46 and 48 were in the same litter, and dogs 83 and 85 in the same.

(*b*) Neutral reaction. In order to make the other test group neutral, 0.02 gm. sodium carbonate plus 0.3 gm. sodium chlorid was added.

(*c*) Basic reaction. In the beginning of the experiment, in order to make the diets basic, 0.45 gm. of sodium carbonate was added and, later on, 0.53 gm. The doses were regulated so as to keep the p_H of the urine at about 8.0.

As may be observed in Table 4, some dogs during the early part of their existence were kept on diets other than those under consideration in this paper. This factor may be of special interest for the biochemist. It has been mentioned here in order that this paper may be more easily correlated with the report of the biochemical analyses. In the consideration of the histologic findings, this factor may

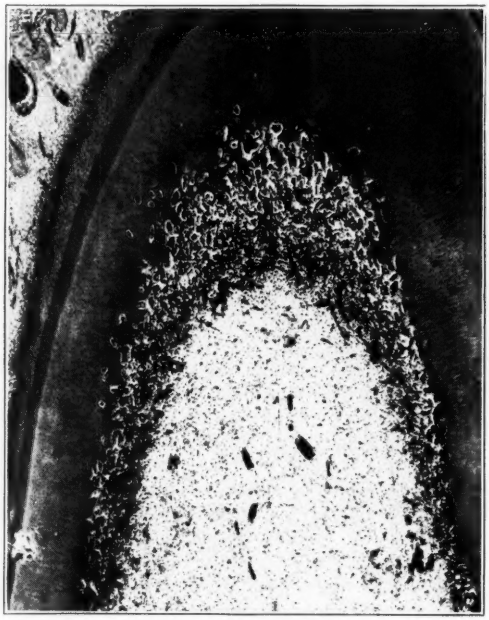

Fig. 5.—Tangential section through a deciduous tooth showing increased resorption of dentin by giant cells as an expression of slight osteoporosis. (Dog 20, normal salt mixture with vitamin D.) (Spec. 719, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b.; eyepiece 4x; extension of camera 50 cm.; ×34.4.)

DOGS ON DIETS

The variations developing through changes in salt mixture, vitamin D content and reaction of food resulted in twelve different diets. The number of dogs was apportioned as shown in Table 3.

be ignored. The main point for a correct interpretation of this experiment is that the animals used, which were killed or died of an intercurrent disease, were fed the diets mentioned in Tables 2 and 3 up to the time of their death, i. e., for several months. Further information re-

garding the diets and the biochemical results may be obtained from the report of Dr. Morgan,[2] which will appear in the near future.

We now turn to the histologic findings in the osseous system, the alveolar process and the labyrinthine capsule. The internal organs were examined as a routine procedure and have been mentioned in this paper only where deviations from the normal were found.

Fig. 6.—Giant cells of Figure 5. (Leitz objective 6a; eyepiece 4x; extension of camera 62.5 cm.; ×440.)

B. HISTOPATHOLOGIC FINDINGS

Dog 21.—A normal salt mixture with cod liver oil (acid diet 4) was fed seven and one-half months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs. There were many vessels within the cartilage. New formation of lamellar bone was found in resorption cavities of the cartilage. The epiphyseal line was straight and arrangement of cartilaginous columns was undisturbed, the columns being of average length. In the subchondral tissue, the number of giant cells was not unusually large. In the subchondral lympathic marrow, there was normal apposition of bone on cartilaginous remnants.

Osteochondral junction of the ribs and long bones. There was resorption by giant cells, only a few of which were present. Fibrous tissue filled the resorp-

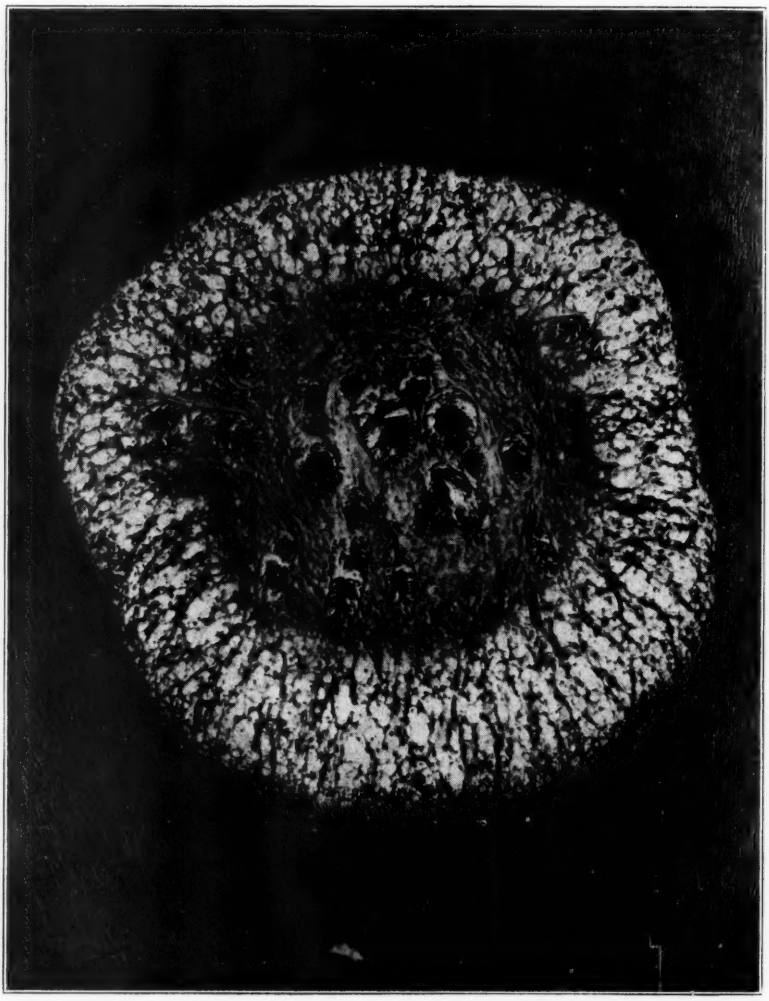

Fig. 7.—Cross-section of tooth; severe degeneration of odontoblastic layer (reticular atrophy). (Dog 20, normal salt mixture with vitamin D.) (Spec. 719, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 75 cm.; ×144.)

tion cavities. There was little apposition on the external surface. The apposing tissue consisted of fiber bone[3] and was separated from the old bone by a cementum line. There were no subperiosteal hemorrhages.

Cortex of the long bones. Cross-section was made through the center of the diaphysis of the radius. In the large marrow cavity, fat marrow was found. There were no hemorrhages. Slight softening of the cortex was noted. Reticulated marrow, but no giant cells, was seen within the resorption cavities. No osteoid tissue was evident. On the exterior surface of the cortex, there was fibrous tissue, showing giant cells. In a few places, new formation of fiber bone had taken place.

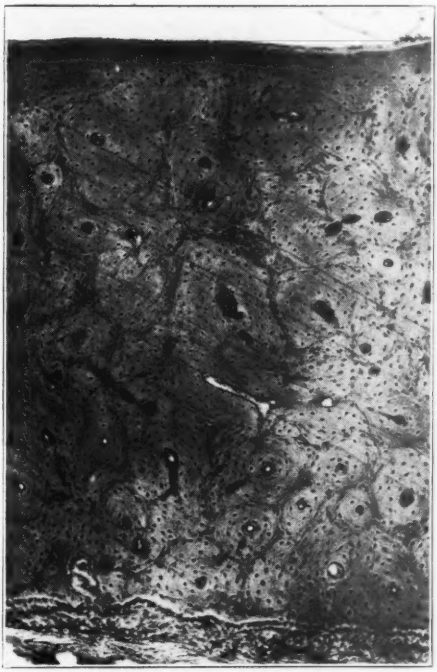

Fig. 8.—Cross-section of right radius, diaphysis; normal density of cortex toward the periosteum; new formation of fibroblastic osteoid following resorption (cementum line). (Dog 48, normal salt mixture with vitamin D.) (Spec. 1935c, embedded in parlodion, stained with hematoxylin-eosion; Leitz objective 3; eyepiece 6x; extension of camera 28 cm.; ×69.)

Bony labyrinth: Capsule and stapes were normal. The labyrinthine capsule was not softened. The bones surrounding the capsule were for the most part normal.

3. Fiber bone (Faserknochen, Weidenreich) is another term for reticulated bone; i. e., bone which, as far as is known, requires no specific osteoblasts for its formation, but is supposed to originate from connective tissue or bundles of fibers, which undergo calcification.

Fig. 9.—Alveolar bone below bifurcation of bicuspid; resorption by giant cells, cavities filled with young mesenchymal tissue. (Dog 48, normal salt mixture with vitamin D.) (Spec. 1942, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 80 cm.; ×153.6.)

Tooth system: The dentin was well calcified. The osteoblasts were in a stage of degeneration. Except for sporadic hemorrhages in the pulp, the pulp tissue was normal.

Paradentium: Normal processes of resorption and apposition were everywhere present. There was an increased number of osteoblasts in the mesial portion of the internal alveolar process, as an expression of mesial movement of the teeth. A small osteoid seam was noted. No hemorrhages were evident in the marrow. Enlarged marrow cavities were filled with fat and reticulated marrow. As the amount of resorption exceeded the amount of apposition, only a little supporting bone remained at the apex. The gingival crevice showed a high degree of infiltration. Inflammatory granulation tissue was seen. The bottom of the pocket was still at the surface of the enamel.

Internal organs: There were no special pathologic findings in these organs.

Summary of bone changes: Processes of resorption as well as apposition were observed but the resorption processes were in the majority.

Diagnosis: Very slight osteoporosis with a tendency toward healing was

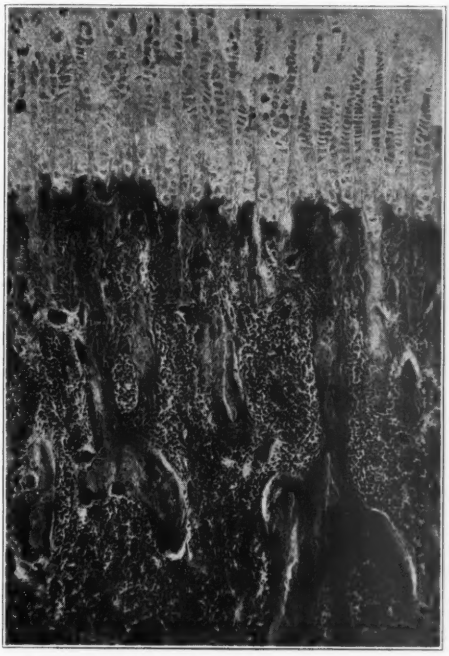

Fig. 10.—Osteochondral junction of fifth rib, inside; epiphyseal line slightly irregular, many giant cells in subchondral marrow space; lymphoid marrow. (Dog 44, normal salt mixture with vitamin D.) (Spec. 1900 A, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 6x; extension of camera 27 cm.; ×77.7.)

diagnosed, a condition that is practically normal.

Dog 46.—The normal salt mixture with cod liver oil (acid diet 4) was fed for nine months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. Few vessels were present within the cartilage. The epiphyseal line was slightly bent, the arrangement of the cartilaginous columns slightly disturbed, with columns comparatively short. A moderate number of giant cells were seen in the subchondral tissue. Lymphatic marrow was seen, with extensive apposition on the cartilaginous remnants.

Osteochondral junction of the ribs and long bones. Resorption by giant cells, which were moderate in number, was evident. In the resorption cavities, fibrous tissue was found, with a moderate amount of apposition. The newly formed material consisted of fiber bone, separated from the old bone by a cementum line. Small isolated subperiosteal hemorrhages were noted.

Cortex of the long bones. A cross-section was made through the center of the diaphysis of the radius, ulna and tibia.

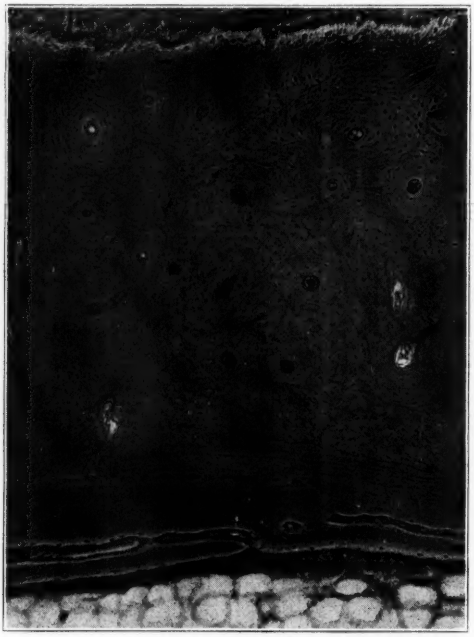

Fig. 11.—Cross-section of right radius, diaphysis; practically normal cortex underneath the periosteum, new formation of fibroblastic osteoid following previous resorption (cementum line). (Dog 44, normal salt mixture with vitamin D.) (Spec. 1901 B, embedded in parlodion; Leitz apochromatic 16 mm.; eyepiece 6x; extension of camera 28 cm.; ×80.6.)

In the large marrow cavities, fat marrow, completely without reaction, was found, with no marrow hemorrhages. The bone of the cortex was very slightly softened. In the cavities, there was reticulated marrow, with no giant cells and no osteoid tissue. On the external surface of the cortex, resorption cavities were filled with fibrous tissue, with no giant cells present.

Tooth system: There was good calcification of the dentin. The odontoblastic layer showed slight degeneration. Isolated hemorrhages were noted on the odontoblastic layer. The dentinoid layer and the pulp tissue were normal.

Paradentium: There was slight apposition of secondary cementum. The alveolar processes showed normal apposition

Fig. 12.—Section of tooth; resorption of cementum and dentin with new formation of secondary cementum; osteoid margin of alveolar bone. (Dog 44, normal salt mixture with vitamin D.) (Spec. 1907, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 62.5 cm.; ×120.)

There were sporadic subperiosteal hemorrhages. A new formation of fibroblastic osteoid and fiber bone was partially covered by osteoblasts. Very little apposition of lamellar bone was to be seen.

with thin osteoid seams but with increased resorption. There was increased softening of the alveolar bone, with many osteoclasts in the marrow cavities and periodontal membrane. Some of the inter-

dental septums are completely resorbed. Distally from the last molar, increased resorptive processes were noted in the alveolar bone. There was increased subepithelial round-cell infiltration, with formation of granulation tissue (paradentitis).

Bony labyrinthine capsule: The stapes was normal. The capsule was not softened. Bone in the vicinity of the labyrinthine capsule was in general normal.

Internal organs: Slight damage to parenchyma of the kidneys was evident.

Summary of the bone changes: Resorption as well as apposition processes were noted, but the resorption exceeded the apposition in several places.

Diagnosis: Slight osteoporosis with apposition (a condition practically normal) was diagnosed.

Dog 20.—The normal salt mixture with cod liver oil (neutral diet 4) was fed. For purposes of this experiment, this dog was not entirely satisfactory as it died of an intercurrent disease after four and one-half months of experiment.

General osseous system: Osteochondral junction of the ribs, internal. There were few vessels within the cartilage.

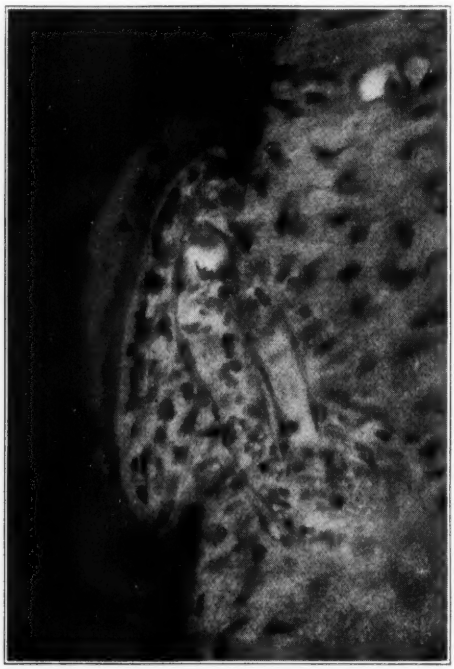

Fig. 13.—Resorption cavity of cementum and dentin, partially filled with secondary dentin. (Specimen shown in Figure 12.) (Dog 44, normal salt mixture with vitamin D.) (Leitz apochromatic 4 mm.; eyepiece 4x; extension of camera 62.5 cm.; ×460.)

No new formation was noted within the cavities. The epiphyseal line was straight and the arrangement of the cartilaginous columns undisturbed, with columns of average length. In the subchondral tissue, there were a few giant cells. There were subchondral hemorrhages. Little apposition was evident on the cartilaginous remnants.

Osteochondral junction of the ribs and long bones. On the external surface, there was resorption by giant cells, which

Fig. 14.—Slight osteoporosis of alveolar bone; giant cells in marrow cavity. (Dog 44, normal salt mixture with vitamin D.) (Spec. 1907, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 80 cm.; ×55.)

Lymphatic marrow was noted, and a small amount of reticulated marrow. were numerous. In the resorption cavities, fibrous tissue was seen. There was

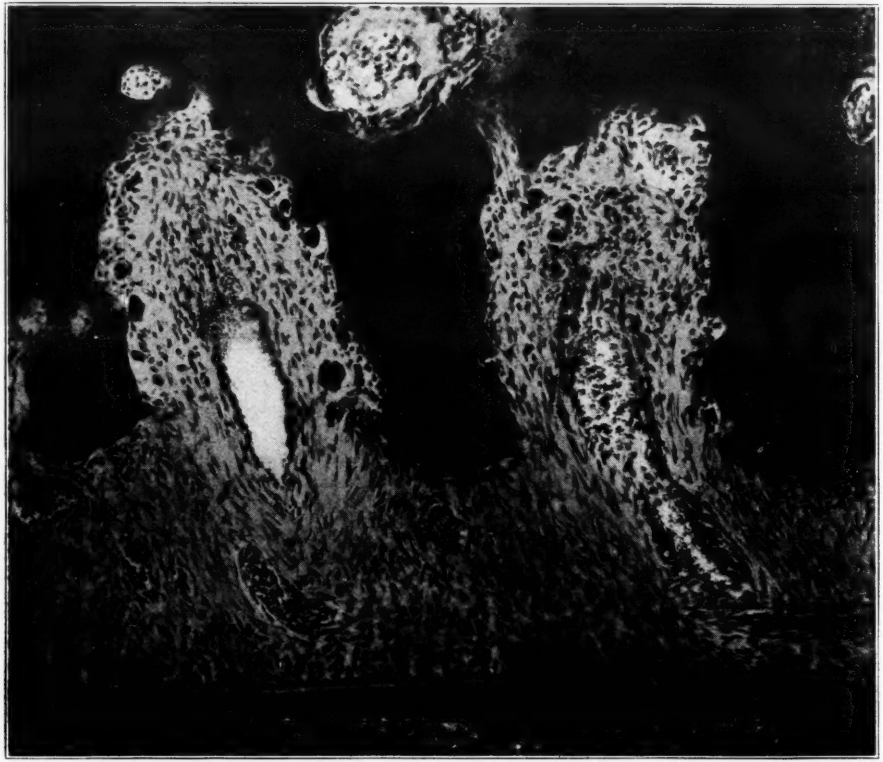

Fig. 15.—Resorption of interalveolar septum by giant cells; communication between marrow cavities of the alveolar bone and loss of attachment of peridental membrane to alveolar bone. (Dog 44, normal salt mixture with vitamin D.) (Spec. 1907, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 67.5 cm.; ×129.)

no apposition. Sporadic subperiosteal hemorrhages were noted.

Cortex of the long bones. A cross-section was made through the middle of the diaphysis of the ulna. In the interior of the large marrow cavity there were fat and lymphoid marrow. No marrow hemorrhages were noted. The bone of the cortex was slightly softened. There was new formation of fibroblastic osteoid tissue. In the fiber bone and lamellar bone, osteoblasts were noted in rows. The newly formed bone was separated from the old bone by a cementum line, which shows that resorption must have taken place previously from the outside.

Tooth system: We were dealing with a very young animal in which the permanent teeth were in process of eruption. The resorption of the alveolar process and of the deciduous teeth was increased to a high degree. The odontoblasts showed great degeneration, and there were many hemorrhagic foci in the odontoblastic layer.

Paradentium: A great increase of large osteoclasts was generally found, which must be considered as the result of osteoporosis. There was normal bone apposition.

Bony labyrinthine capsule: The stapes was normal. The capsule was not softened but was completely normal. There was much well-formed lamellar bone.

Internal organs: There was severe parenchymatous degeneration of the kidney. The cause of death was nephritis.

Summary of the bone changes: Evidently, increased resorption had taken

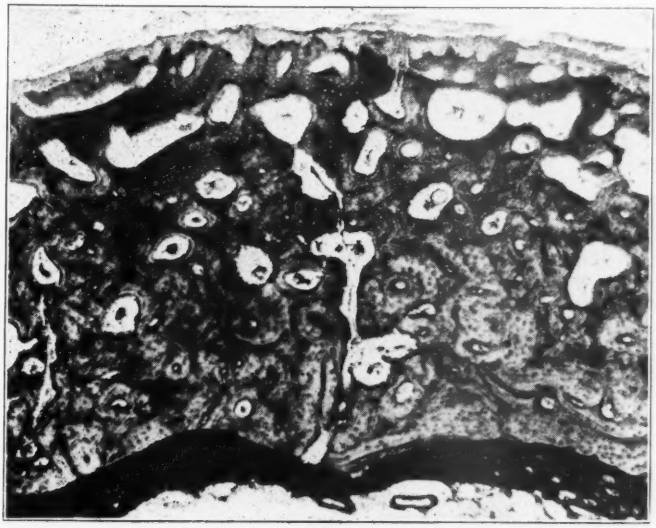

Fig. 16.—Cross-section of right radius, diaphysis; slight osteoporosis of cortex; resorption cavities filled with reticulated marrow. (Dog 41, normal salt mixture without vitamin D.) (Spec. 1854c; embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 67 cm.; ×46.1.)

place a long time previous to the death of the animal. This was still present, although, in most areas, new lamellar bone has been apposed.

Diagnosis: Slight osteoporosis with apposition, a condition practically normal, was diagnosed.

Dog 48. — The normal salt mixture with cod liver oil (neutral diet 4) was fed for nine months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. There were many vessels within the cartilage. New formation of lamellar bone was seen in the resorption cavities. The epiphyseal line was straight; the arrangement of the cartilaginous columns regular, and columns were of average length. In the subchondral tissue were many giant cells. There was lymphatic marrow and a little reticulated marrow in the subchondral tissue. No marrow hemorrhages were noted. There was increased apposition on the cartilaginous remnants.

Osteochondral junction of the ribs and long bones, external. The epiphseal cartilage of the long bones has already dis-

Fig. 17.—Bony labyrinthine capsule; slight osteoporosis, giant cells, osteoid margins, reticulated marrow. (Dog 41, normal salt mixture without vitamin D.) (Spec. 1858V-45, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 44 cm.; ×84.4.)

appeared. There were a few giant cells and fibrous tissue in the resorption cavities. No apposition was noted at the external surface, and there were no subperiosteal hemorrhages.

Cortex of the long bones. A cross-section was made through the center of the diaphysis of the radius, ulna and tibia. In the large marrow cavity there was fat marrow. No marrow hemorrhages were seen. The bone of the cortex was only slightly softened. There was reticulated marrow in the cavities. Very few giant cells were present. No osteoid tissue was seen. On the external surface of the cortex, there were giant cells and fibrous tissue. There were no subperiosteal hemorrhages. There was little apposition of fibroblastic osteoid tissue after resorption (cementum line), little fiber bone and little new formation of lamellar bone.

Tooth system: This was normal, with the exception of a very slight degenerative process of the odontoblastic layer. Isolated hemorrhages were seen in the pulp.

Paradentium: There was a slight increase of bone resorption by giant cells. The marrow cavity contained fat and reticulated marrow. Very slight infiltration of the gingiva was evident.

Bony labyrinthine capsule: The stapes was normal. The capsule was not softened (normal) and adjacent bones were normal.

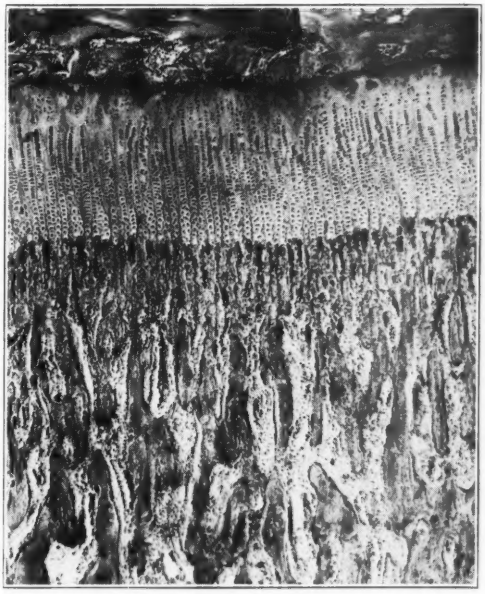

Fig. 18.—Section of right tibia, distal, epiphyseal line; practically normal cartilaginous columns; only a few giant cells in subchondral marrow space. (Dog 26, normal salt mixture without vitamin D.) (Spec. 969A, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 60 cm.; ×41.3.)

Internal organs: The kidneys showed pericapsular hemorrhages, albumin in capsular spaces, glomeruli rich in cells, hyaline cylinders and slight parenchymatous degeneration (nephritis). The other organs were normal.

Summary of the bone changes: There was increased resorption, which is compensated in several places.

Diagnosis: Slight osteoporosis with apposition was diagnosed (condition practically normal).

subchondral tissue were many giant cells. Lymphatic marrow was noted. There was a moderate amount of apposition on the cartilaginous remnants.

Osteochondral junction of the ribs and long bones, external. The epiphyseal cartilage of the long bones had almost completely disappeared. There was resorption on the outside, with many giant cells; fibrous tissue in the resorption cavities and little apposition. The newly formed material consisted of fiber bone, separated

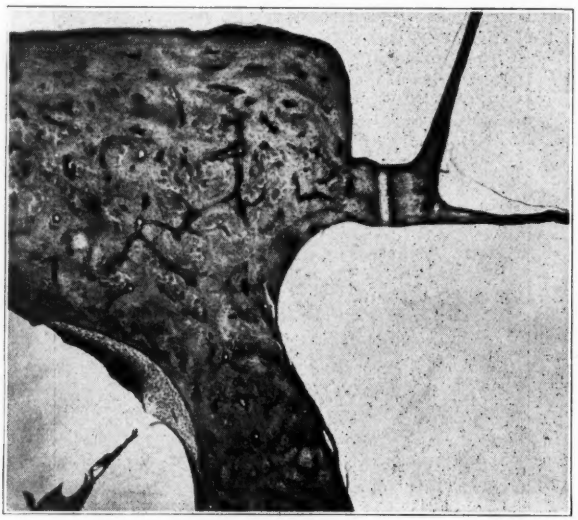

Fig. 19.—Normal labyrinthine capsule, normal stapes. (Dog 26, normal salt mixture without vitamin D.) (Spec. 970-55, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 55 cm.; ×37.8.)

Dog 44. — The normal salt mixture with cod liver oil (basic diet 4) was fed nine months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. Few vessels were seen within the cartilage. The epiphyseal line was slightly bent; the arrangement of the columns only slightly disturbed, with columns short. In the by a cementum line from the old bone. No subperiosteal hemorrhages were present.

Cortex of long bones. A cross-section was made through the center of the diaphysis of the radius, ulna and tibia. In the large marrow cavities, there was fat marrow. No marrow hemorrhages were noted.

The bone of the cortex was only slightly softened. In the cavities, reticulated marrow with very few giant cells was seen. A small amount of osteoid tissue was noted. On the external surface of the cortex giant cells, there was fibrous marrow. No subperiosteal hemorrhages were evident. There was new formation of fibroblastic osteoid tissue.

Fig. 20.—Section of tooth, degeneration of the enamel epithelium at the cemento-enamel junction. (Dog 26, normal salt mixture without vitamin D.) (Spec. 973B, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 62.5 cm.; ×43.)

Fiber bone was seen. Lamellar bone was separated from the old bone by a cementum line. Osteoblasts were in rows.

Tooth system: Good calcification of dentin was evident. There was a high degree of degeneration of the odontoblastic layer. Severe hemorrhages were noted in the pulp. The dentinoid layer was thickened, which may have been due to the degeneration of the odontoblastic layer.

Paradentium: There was a small osteoid seam. An increase in the number of osteoclasts indicated mesial movement of the teeth. The marrow cavities were slightly enlarged, with osteoclasts attached to the walls. Fat and reticulated marrow was noted. There were large resorption cavities in the cementum.

The gingiva showed increased infiltration, with granular tissue and pus discharge. Pyorrheic disease of the gingiva and subepithelial tissue was evident.

Bony labyrinthine capsule: The stapes was normal. The capsule was only slightly softened. Adjacent bone was slightly irritated. Fibrous marrow was noted. Bone rebuilding was in progress.

Diagnosis: Slight osteoporosis with apposition was diagnosed (practically normal).

Dog 41.—The normal salt mixture without cod liver oil (acid diet 4a) was fed nine months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. Many

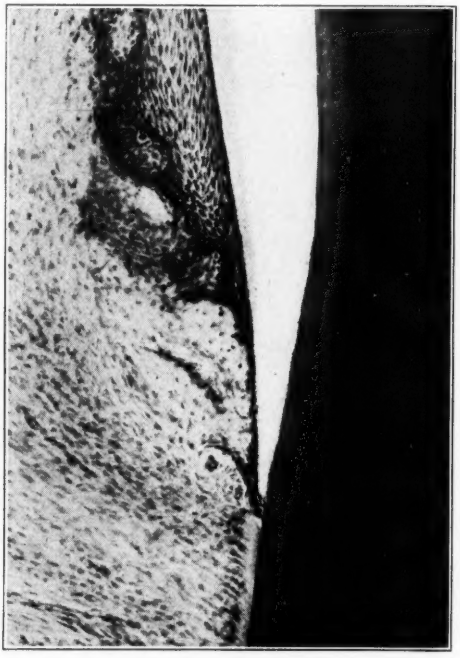

Fig. 21.—Enlargement of area surrounding cemento-enamel junction of Figure 20. (Dog 26, normal salt mixture without vitamin D.) (Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 62.5 cm.; ×120.)

Internal organs: Hyaline casts were evident on urinalysis. Hyperemia was present.

Summary of the bone changes: A slight increase of resorption was accompanied by almost normal apposition.

vessels were seen within the cartilage. There was new formation of lamellar bone in the resorption cavities. The epiphyseal line was straight, arrangement of cartilaginous columns undisturbed, with columns short. Many giant cells

were present. Lymphoid marrow and hemorrhages in the subchondral region were noted. There was little apposition of bone on the long cartilaginous remnants.

Osteochondral junction of the ribs and long bones, external. The epiphyseal cartilage of the long bones was completely absent. Resorption was noted on the exterior portion. Many giant cells were present. Fibrous tissue filled the resorption cavities. No apposition was evident on the external surface.

Cortex of the long bones. A cross-section was made through the middle of the diaphysis of the radius and ulna. In the interior of the large marrow cavity there was fat marrow, lymphoid marrow and disseminated hemorrhages. Slight softening of the cortex was evident. Reticulated marrow and a few giant cells were seen within the resorption cavities. No osteoid tissue was present. On the exterior side of the cortex there were giant cells and fibrous tissue, but no subperiosteal hemorrhages and no new formation of bone.

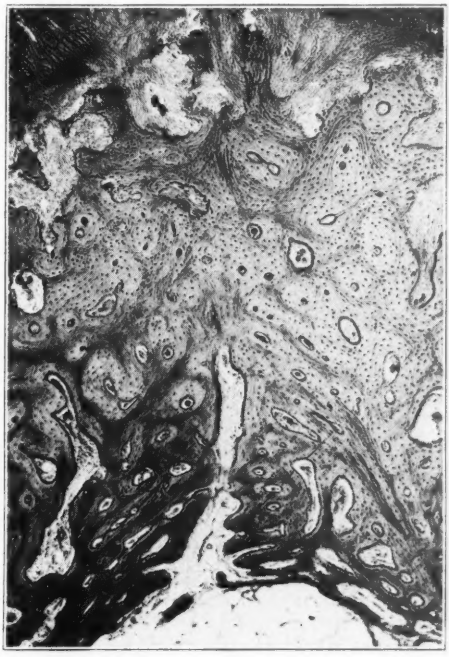

Fig. 22.—Cross-section of right ulna, diaphysis; osteoporosis of cortex, resorption cavities filled with reticulated marrow containing giant cells; no osteoid tissue. (Dog 43, normal salt mixture without vitamin D.) (Spec. 1886-B, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 54 cm.; ×37.1.)

Bony labyrinthine capsule: The stapes was normal. The capsule showed several resorption cavities filled with reticulated

marrow. There were signs of new bone formation. Osteoblasts were seen and a very small amount of osteoid tissue. The bone surrounding the labyrinthine capsule showed reticulated marrow and disseminated hemorrhages at various points.

Internal organs: There were no pathologic findings.

Summary of bone changes: Processes of resorption as well as apposition were observed. The amount of resorption slightly exceeded that of the normal, while the amount of apposition was normal or slightly decreased. The reticulated marrow and the hemorrhages suggested scurvy, while the osteoid tissue in connection with giant cells revealed a reconstruction (transformation) of bone. One is therefore dealing rather with a hypoostotic porotic form of osteodystrophia fibrosa.

Diagnosis: Slight osteoporosis with healing tendency (healing scurvy, osteodystrophia fibrosa?) was diagnosed.

Dog 26. — The normal salt mixture without cod liver oil (neutral diet 4a) was fed six and one-half months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. Many vessels were noted within the cartilage. New formation of lamellar bones in the resorption cavities was evident. The epiphyseal line was straight. The columns themselves were normal, with the arrangement only slightly disturbed. A few giant cells were seen in the subchondral tissue. Reticulated marrow and hemorrhages were noted. There was normal apposition on the cartilaginous remnants.

Osteochondral junction of the ribs and long bones, external. Much resorption was evident, with many giant cells. Fibrous tissue was seen in the resorption cavities. New formation was very meager. Newly formed material consisted of lamellar and fiber bone, the latter predom-

Fig. 23.—Section of left ear; endosteal layer of labyrinthine capsule showing small osteoid area (osteolysis?). (Dog 43, normal salt mixture without vitamin D.) (Spec. 1889H-20, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 4 mm.; eyepiece 4x; extension of camera 63 cm.; ×464.)

inating. It was separated from the old bone by a cementum line. Very few subperiosteal hemorrhages were evident.

Cortex of the long bones. A cross-section was made through the center of the diaphysis of the radius, ulna and tibia. In the large marrow cavities, lymphatic marrow and extensive marrow hemorrhages were evident. The bone of the cortex was distinctly softened in several places. Reticulated marrow with few giant cells in the cavities were noted. No osteoid tissue was seen. On the external surface of the cortex, there were giant cells, fibrous tissue and a few subperiosteal hemorrhages. New formation of fibroblastic osteoid tissue was noted, and fiber bone. Lamellar bone was separated from the old bone by a cementum line. On the outside, osteoblasts were seen in a row.

Tooth system: In contrast to the group taking cod liver oil, this animal showed normal structure of the odontoblastic layer. There were no hemorrhages in the pulp.

Paradentium: There was normal bone apposition, with a small osteoid seam. Hyperemia of the enlarged marrow cavities was noted. Mesial resorption of the alveolar process had resulted from tooth movement. There was slight loosening of the alveolar bone. A marked degree of inflammation was evident in the region of the gingiva, with granulation tissue. In certain areas, hemorrhages had occurred. Pus discharged from shallow pockets. The enamel epithelium was partly degenerated at the cemento-enamel junction and had disappeared in a number of places, i.e., damage to the ectoderm had occurred.

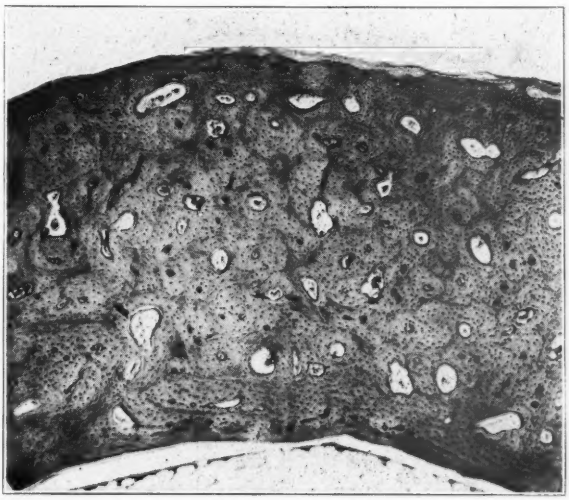

Fig. 24.—Cross-section of right radius, diaphysis; cortex softened; many resorption cavities filled with reticulated marrow. (Dog 24, normal salt mixture without vitamin D.) (Spec. 945A, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 53 cm.; ×36.4.)

Bony labyrinthine capsule: The stapes was normal. The capsule was softened. Bone of the environment was normal and there was much well-formed lamellar bone.

Internal organs: These were normal.

Summary of the bone changes: Slight increase of resorption, with normal apposition process and distinct marrow hemorrhages, was evident.

Diagnosis: Slight osteoporosis with healing tendency (healing scurvy?) was diagnosed (condition almost normal).

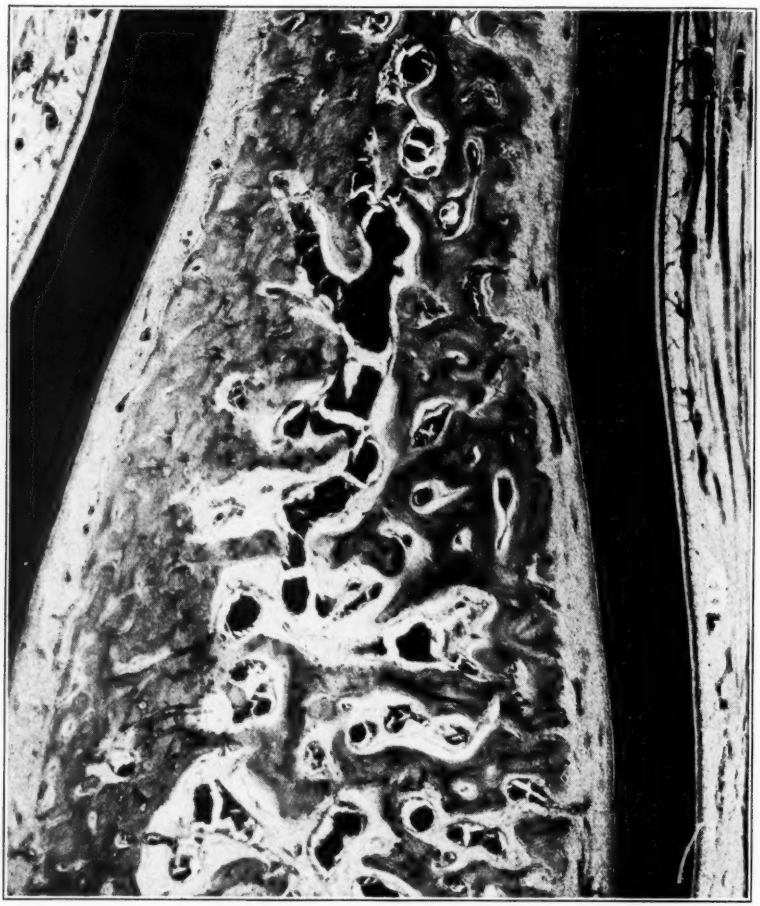

Fig. 25.—Section of interdental alveolar bone; hyperemia of marrow cavities. (Dog 24, normal salt mixture without vitamin D.) (Spec. 951B, embedded in parlodion, stained with hematoxylin-eosin; Leitz microsummar 24; extension of camera 26 cm.; ×26.)

Dog 43. — The normal salt mixture

without cod liver oil (neutral diet 4a) was fed nine months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs. No examination was made. The osteochondral junction of the long bones had already completely disappeared.

Cortex of the long bones. A cross-section was made through the center of the diaphysis of the radius and ulna. In the large marrow cavities, fat marrow was noted. There were no marrow hemorrhages.

Bone of the cortex. This was somewhat softened. There was reticulated marrow with many giant cells in the cavities. No osteoid tissue was seen. On the external surface of the cortex were many giant cells, fibrous marrow and extensive resorption, with no new formation of bone.

Tooth system: The odontoblastic layer was normal. There were no hemorrhages in the pulp. The dentinoid layer was of normal width. Very meager formation was noted.

Paradentium: Bone apposition was normal. A small amount of osteoid tissue was present. There was extensive softening of the alveolar bone. The marrow cavities were enlarged and showed hyper-

Fig. 26.—Bony labyrinthine capsule; resorption cavities containing giant cells and reticulated marrow. (Dog 24, normal salt mixture without vitamin D.) (Spec. 948-45, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 48 cm.; ×92.)

emia. Inflammatory infiltration of the gingiva and also a high degree of degeneration of the enamel epithelium, which must have taken place before the eruption of the teeth (damage to the ectodermal portion of the paradentium), were noted.

Bony labyrinthine capsule: The stapes was normal. The capsule itself was not softened, but at the margin of the endosteal capsule, there was a peculiar gnawed appearance, which may not have been caused by activity of giant cells (halisteresis? osteolysis?). The environment was normal.

Internal organs: These were normal.

Summary of bone changes: There was an extensive resorption process, with no marked apposition.

Diagnosis: True osteoporosis was diagnosed.

Dog 24. — The normal salt mixture without cod liver oil (basic diet 4a) was fed seven months, when the animal was killed.

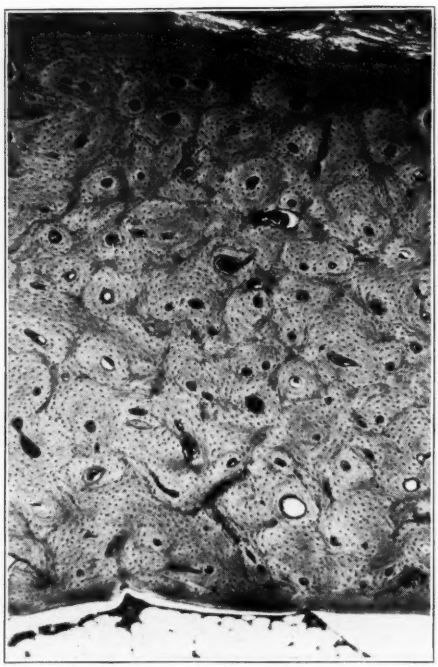

Fig. 27.—Cross-section of right radius, diaphysis; normal. (Dog 30, normal salt mixture without vitamin D.) (Spec. 993C, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 57 cm.; ×39.2.)

General osseous system: Osteochondral junction of the ribs, internal. There were a few vessels within the cartilage. The epiphyseal line was straight, the arrangement of the cartilaginous columns slightly disturbed, with columns short. A few

giant cells were present in subchondral tissue. Lymphatic marrow hemorrhages and a moderate amount of apposition on the cartilaginous remnants were noted.

Osteochondral junction of the ribs and long bones, external. Resorption with many giant cells and little apposition was noted. The material which had been apposed consisted of fiber bone and was there was fat marrow. Marrow hemorrhages were noted. The bone of the cortex was slightly softened. Reticulated marrow was noted in the cavities. A few giant cells were present. There was no osteoid tissue.

On the outside of the cortex, isolated giant cells and fibrous marrow were noted. No hemorrhages were present.

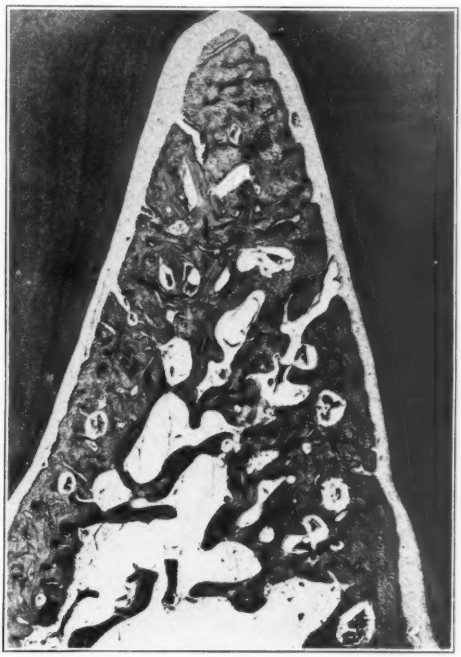

Fig. 28.—Section of alveolar process, practically normal. (Dog 30, normal salt mixture without vitamin D.) (Spec. 989A, embedded in parlodion, stained with hematoxylin-eosin; Leitz microsummar 42; extension of camera 82.5 cm.; ×20.6.)

separated from the old bone by a cementum line. A few subperiosteal hemorrhages were noted.

Cortex of the long bones. A cross-section was made through the center of the diaphysis of the radius, ulna, tibia and fibula. In the large marrow cavities Very little new formation of fiber bone was seen. Separation was by a cementum line.

Tooth system: Good calcification of dentin with slight degeneration of the odontoblastic layer and extensive hemorrhages in the pulp, was seen.

Paradentium: Here, there was hyperemia of the pulp and marrow cavity. Osteoid seams and extensive softening of the alveolar bone were noted. Osteoblasts were to be found in all parts of the alveolar bone. There was slight degeneration. A reduction of the enamel epithelium at the cemento-enamel junction was not so distinct as was the case in Dog 26. (The epithelial changes will be discussed more fully later.) There was inflammation in the region of the gingiva.

Bony labyrinthine capsule: The stapes was normal. The capsule was slightly softened. Reticulated marrow was noted in the cavities, with giant cells and hemorrhages. Hemorrhages were seen in the endosteum of the endosteal capsule at the helicotrema. Serum is present in the membraneous labyrinth of this region. The bone surrounding the capsule was normal, with the exception of hemorrhages in the marrow.

Internal organs: These were normal.

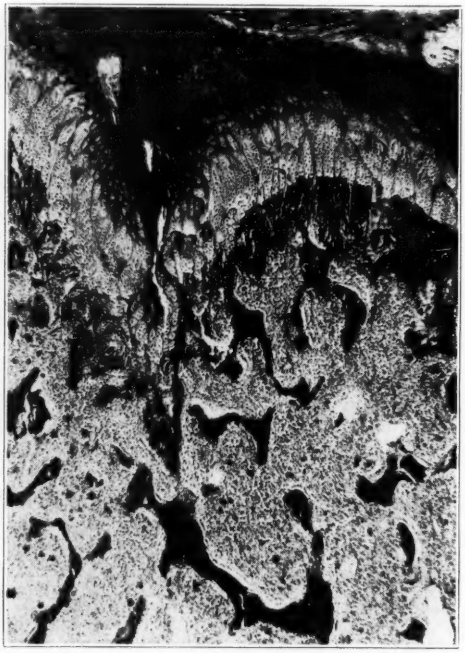

Fig. 29.—Osteochondral junction of fifth rib, inside; irregularity of cartilage. (Dog 42, normal salt mixture without vitamin D.) (Spec. 1869B, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 50 cm.; ×34.4.)

Summary of the bone changes: Increased resorption was paralleled by apposition. The hemorrhages may be indicative of scurvy.

Diagnosis: Osteoporosis with healing tendency (healing scurvy?) was diagnosed,

Dog 30. — The normal salt mixture, without cod liver oil (basic diet 4a) was fed one month, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. Many vessels were seen within the cartilage. New formation of lamellar bone had occurred in the resorption cavities. The epiphyseal line was much bent, and arrangement of the cartilaginous columns was disturbed, with columns of normal length. Very few giant cells were seen in the subchondral tissue. Lymphatic marrow was present. An average amount of apposition was seen on the cartilaginous remnants.

Osteochondral junction of the ribs and long bones, external. There had been a complete disappearance of the epiphyseal cartilage of the long bones. There was resorption, with many giant cells and fibrous tissue in the cavities. Little apposition was noted. There were a few subperiosteal hemorrhages.

Cortex of the long bones: A cross-section was made through the center of the diaphysis of the radius, ulna, tibia and fibula. In the large marrow cavities,

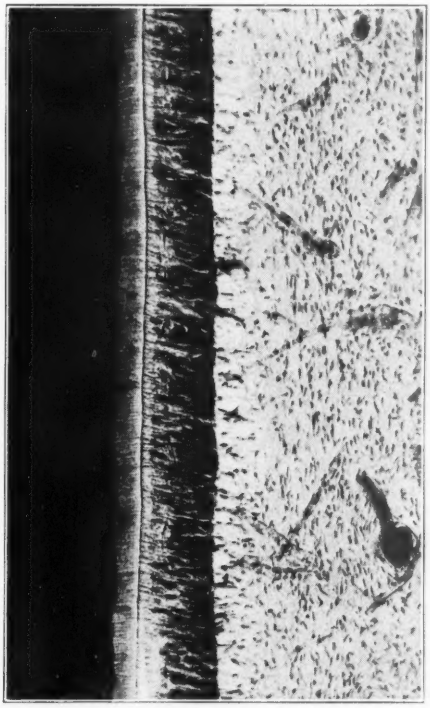

Fig. 30.—Section of tooth, degeneration of odontoblastic layer (reticular atrophy). (Dog 76, low calcium with vitamin D.) (Spec. 1807, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 62.5 cm.; ×120.)

Fig. 31.—Section of interdental bone; brown tumor, typical picture of osteodystrophia fibrosa (intra-osseus epulis); reticulated and fibrous marrow, new formation of islands of fibroblastic osteoid and fiber bone, giant cells, blood filled mesenchymal sponge. Original interdental bone has been destroyed completely. (Dog 76, low calcium with vitamin D.) (Spec. 1807, embedded in parlodion, stained with hematoxylin-eosin; Leitz microsummar 24; extension of camera 65 cm.; ×32.)

Fig. 32.—Section of interdental bone with cysts and remnants of original alveolar process. (Dog 76, low calcium with vitamin D.) (Spec. 1807, embedded in parlodion, stained with hematoxylin-eosin; Leitz microsummar 24; extension of camera 65 cm.; ×32.)

fat marrow was present. A few marrow hemorrhages were noted. The bone of the cortex was not softened.

On the outside of the cortex were single giant cells and fibrous tissue. Formation of a little new fiber bone and

lamellar bone were noted. The latter was separated from the old bone by a cementum line. No osteoblasts were seen in rows.

Tooth system: The odontoblastic layer was degenerating. There were severe hemorrhages in the pulp. The structure of the pulp tissue was normal.

Paradentium: Bone apposition was normal, with meager osteoid seams. A slight softening of the alveolar bone was noted. The marrow cavities were filled with lymphatic and fat marrow. A few osteoclasts were present. The gingiva shows slight inflammatory changes resulting from deposits (slight gingivitis).

Bony labyrinthine capsule: The stapes was normal. The capsule was not softened, and surrounding bone was normal.

Internal organs: Parenchymatous degeneration of the kidneys was evident.

Summary of the bone changes: A large amount of apposition was present, with an increased resorption. According to these findings, the bone condition seemed to be normal when the animal was killed.

Diagnosis: There was a practically normal bone system (hemorrhages).

Dog 42. — The normal salt mixture, without cod liver oil (basic diet 4a), was fed seven and three-quarter months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. Many vessels were found within the cartilage. New formation of lamellar bone was taking

Fig. 33.—Bony labyrinthine capsule; many wide resorption cavities filled with reticulated marrow, giant cells, osteoblasts; new formation of bone (osteoid tissue). (Dog 76, low calcium with vitamin D.) (Spec. 1805-30, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 6x; extension of camera 38 cm.; ×105.4.)

place in the resorption cavities. The epiphyseal line was much distorted.

The arrangement of the cartilaginous columns was disturbed. A few giant cells were present in the subchondral tissue. Lymphatic marrow and a moderate amount of apposition on the cartilaginous remnants were noted.

Osteochondral junction of the ribs and long bones. There was complete disappearance of the epiphyseal cartilage of the long bones. Resorption; many giant cells; was fat marrow with no marrow hemorrhages. The bone of the cortex was not softened. On the external surface of the cortex there were giant cells and fibrous marrow. No subperiosteal hemorrhages were seen. There was no new formation of bone.

Tooth system: There was a very slight degeneration of the odontoblastic layer. No hemorrhages were noted.

Paradentium: Enlargment of marrow cavities, softening of the alveolar bone

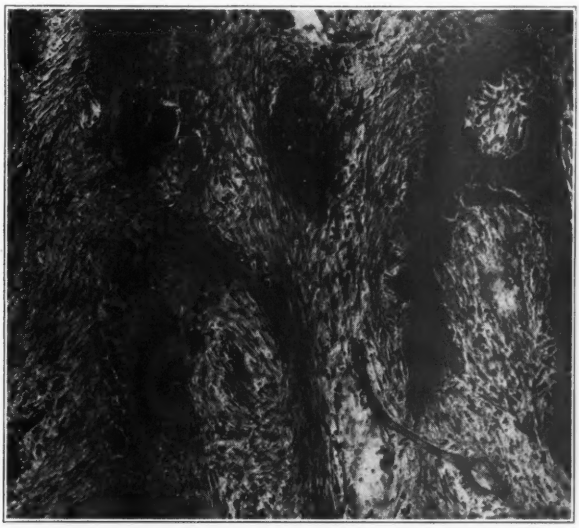

Fig. 34.—Section of right ulna, region underneath the periosteum, distally from proximal epiphyseal line; typical picture of osteodystrophia fibrosa: fibrous marrow, islands of fibroblastic osteoid tissue and fiber bone, giant cells. (Dog 60, low calcium without vitamin D.) (Spec. 1785A, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 57 cm.; ×109.4.)

fibrous tissue in the cavities and no apposition were noted, with no subperiosteal hemorrhages.

Cortex of the long bones: A cross-section was made through the center of the diaphysis of the radius, ulna, tibia and fibula. In the large marrow cavities, there and the presence of giant cells in moderate number were noted. The marrow cavities were filled with fat, lymphatic and reticulated marrow. The gingiva was highly inflamed. There was a slight secretion from the pockets (pyorrheic conditions).

Bony labyrinthine capsule: The stapes was normal. The capsule had not been softened. Surrounding bone was normal.

Internal organs: There was parenchymatous degeneration of the kidneys, with albumin in the glomerular spaces.

Summary of the bone changes: No marked new formation of bone was present. Slight resorption processes were seen.

Diagnosis: Slight osteoporosis was diagnosed.

Dog 76.—The low calcium salt mixture, with cod liver oil (basic diet 11) was fed three months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. There were few vessels within the cartilage. No new formation of lamellar bone was seen in the resorption cavities. The epiphyseal line was straight; the arrangement of cartilaginous remnants not disturbed, with columns of normal length. Many giant cells were present in the subchondral tissues. Fibrous marrow, reticulated marrow and hemorrhages were noted. A moderate amount of apposition was present on the few cartilaginous remnants.

Osteochondral junction of the ribs and long bones, external. Resorption, many giant cells and fibrous tissue in the cavities were noted. A considerable amount of apposition was present. The newly formed bone consisted of fibroblastic islands, which were partially separated from the old bone by a cementum line. This new bone was present in an osteoid stage and was chiefly made up of fiber bone. Extensive subperiosteal hemorrhages were evident.

Cortex of the long bones: A cross-section was made through the center of the diaphysis of the radius, ulna, tibia and fibula. In the large marrow cavities, fat

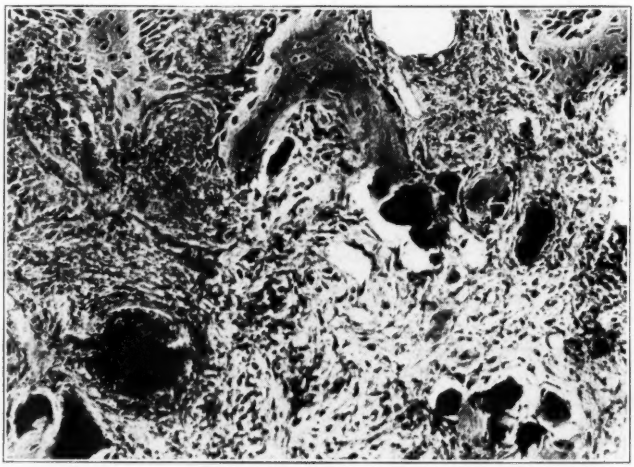

Fig. 35.—Osteodystrophia fibrosa of alveolar bone; young mesenchymal tissue, fibrous marrow, giant cells, fibroblastic osteoid tissue, fiber bone with osteoid margin. (Dog 60, low calcium without vitamin D.) (Spec. 1795, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 65 cm.; ×125.)

marrow and, rarely, marrow hemorrhages were seen. The bone of the cortex was extensively softened. Reticulated marrow was seen in the cavities. Many giant cells but also many osteoblasts were seen in rows. The newly formed bone, which consisted partially of osteoid tissue, was separated from the old bone by a cementum line.

External surface of the cortex. Many giant cells, fibrous tissue and few subperiosteal hemorrhages were noted. The new formation of fibroblastic osteoid tissue was in "T" form. Fiber bone and lamellar bone was separated from the old bone by a cementum line. Osteoblasts were in rows.

Tooth system: There was good calcification of the dentin. A marked degree of degeneration of the odontoblastic layer was noted. A few hemorrhages were present in the pulp. The dentinoid layer was very thick. The pulp tissue was almost completely degenerated and consisted mostly of vacuoles. The alveolar part of the paradentium showed extensive changes.

The interdental septums were almost completely resorbed by osteoclasts, loosening of the teeth resulting clinically.

Paradentium: In several places, the newly formed bone had already been destroyed. Osteoclasts rule the picture. Some of the cysts, which were both large and small, were filled with blood, others were empty. The tissue meshes were filled with blood and the whole picture represented the typical brown tumor characteristic of osteodystrophia fibrosa. The gingiva was highly inflamed and showed the typical picture of paradentosis.

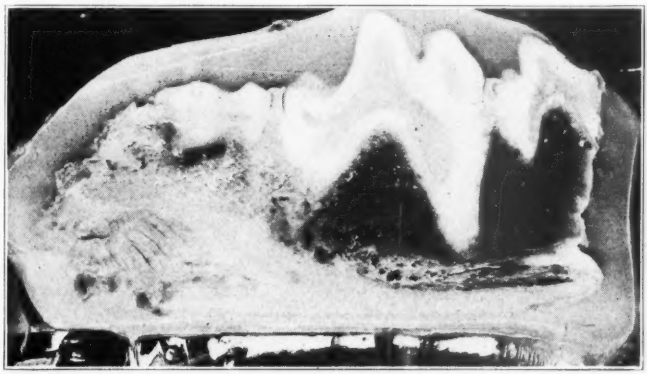

Fig. 36.—Section of lower molars; "brown tumor." (Dog 60, low calcium without vitamin D.) (Spec. 1795, embedded in parlodion, unstained block; low power photography about natural size.)

Bony labyrinthine capsule: The stapes was not sectioned. The labyrinthine capsule showed extensive softening. The haversian systems were extensively enlarged. In the cavities were giant cells, reticulated marrow, osteoblasts in rows and osteoid tissue. A cementum line separated new and old bone. The bone of the environment showed a regenerative process.

Internal organs: These were normal.

Summary of the bone changes: Extensive apposition was present, with a large amount of resorption. The apposition for the most part followed the resorption. There was more resorption than apposition. Osteoid tissue and hemorrhages were noted.

Diagnosis: Generalized osteodystrophia fibrosa (von Recklinghausen) with pseudotumors and cysts in the jaws was diagnosed.

Dog 60.—The low calcium salt mixture without cod liver oil (acid diet 11a) was fed five and a quarter months, when the animal was killed.

General osseous system: The bones were easily cut.

Osteochondral junction of the ribs, internal. Few vessels were seen within the cartilage. There was no new formation of lamellar bone in the resorption cavities. The epiphyseal line was bent; the arrangement of the cartilaginous columns slightly disturbed, with columns of normal length. The epiphyseal plate was irregularly opened by vessels containing

Fig. 37.—Section of brown tumor (intraosseus epulis), typical picture of osteodystrophia fibrosa: blood-filled mesenchymal sponge, reticulated marrow, islands of fibroblastic osteoid tissue, fiber bone, giant cells, cysts, blood lakes. (Dog 60, low calcium without vitamin D.) (Spec. 1795, embedded in parlodion, stained with hematoxylin-eosin; Leitz microsummar 80; extension of camera 60 cm.; ×7.5.)

much blood. A large number of giant cells and osteoblasts were seen in the subchondral tissue. There was reticulated marrow, but still more fibrous marrow, with extensive hemorrhage. A large amount of apposition was seen on the cartilaginous remnants, which were in abnormal position. The newly formed bone consisted, for the most part, of fiber bone to which, at certain places, osteoblasts were attached in rows, but true lamellar bone was not present. Directly subchondrally were many islands of fibroblastic osteoid tissue, which formed a very dense mass.

Osteochondral junction of the ribs and long bones, external. Large amount of resorption, many giant cells and very dense fibrous tissue in the cavities were noted. Extensive apposition was noted, the newly formed material consisting mostly of fibroblastic osteoid and fiber bone which was separated from the old bone by a cementum line. There were many free islands of fibroblastic bone formation, with isolated subperiosteal hemorrhages.

Cortex of the long bones: A cross-section was made through the center of the diaphysis of the radius, ulna, tibia and fibula. In the large marrow cavities were fat and lymphatic marrow and a few marrow hemorrhages. The bone of the cortex was extensively softened. In the cavities, reticulated marrow with many giant cells was seen. A very thin band of osteoid tissue was noted. On the external surface of the cortex were giant cells, fibrous tissue, isolated subperiosteal hemorrhages. New formation of fibroblastic osteoid and fiber bone was separated from the old bone by a cementum line with openings to the outside. On the outside of the fiber bone, osteoblasts oc-

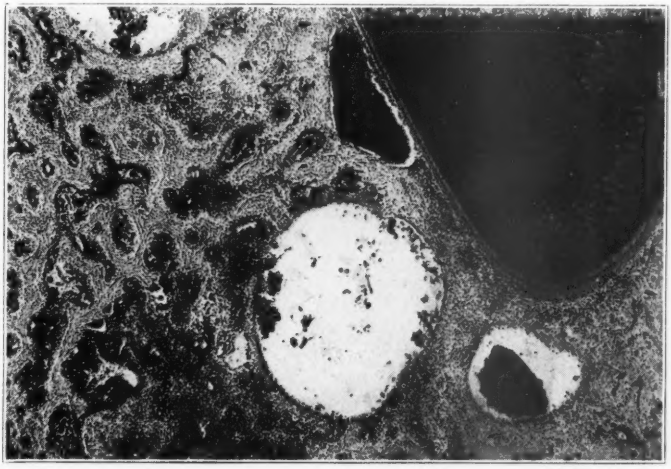

Fig. 38.—Tangential section of root, brown tumor (pseudotumor); cysts and pseudo-cysts; typical picture of osteodystrophia fibrosa. (Dog 60, low calcium without vitamin D.) (Spec. 1795, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 57.5 cm.; ×39.5.)

curred in rows, but evidently there was no new formation of lamellar bone.

Skull. The cortex of bone was extensively softened. The cavities were filled with reticulated and fibrous marrow. In the marrow were islands of fibroblastic bone and areas of resorption. In only a few places was normal fat marrow found.

Tooth system: The dentin was very irregular and was also poorly calcified.

Paradentium: The whole alveolar process of the upper and lower jaws was changed into a bone mass, which was easily cut with a knife before decalcification and appeared brown macroscopically. Microscopically, the former interdental bone had almost entirely disappeared by resorption processes. Many osteoclasts were visible in the remnants and the fibrous marrow tissue. A large amount of new formation of fiber bone and fibroblastic osteoid tissue was to be found everywhere. The calcification of the newly formed bone was very poor. The

Fig. 39.—Crest of interalveolar bone; typical picture of osteodystrophia fibrosa: nearly complete resorption of original alveolar process, new formation of fibroblastic osteoid tissue and poorly calcified fiber bone, giant cells, fibrous marrow. There is loss of attachment of Sharpey's fibers supporting the teeth. Such a picture might explain clinical loosening of teeth (paradentosis). (Dog 60, low calcium without vitamin D.) (Spec. 1795, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 62.5 cm.; ×120.)

tissue meshes were filled with blood, while, in the fibrous stage, only hemosiderin pigment was to be found. In the vicinity of the teeth, and especially in the region of the periodontal membrane, large and small blood filled and empty cysts appear. The gingiva showed large areas of round-cell infiltration and subepithelial granulation tissue formation.

Diagnosis: The diagnosis was: brown tumors of the jaws, characteristic of osteodystrophia fibrosa.

There was very little new formation in the cavities. The osteoid tissue was separated from the old bone by a cementum line. Osteoblasts were attached to the osteoid tissue in an epithelial-like arrangement. The endosteal capsule showed severe resorption toward the membraneous labyrinth, but no giant cells could be found.

Bone adjacent to labyrinth. Resorption, fibrous marrow (typical osteodystrophia fibrosa) and apposition in the

Fig. 40.—Typical osteodystrophia fibrosa in bone surrounding labyrinthine capsule: giant cells, fibrous marrow, islands of fibroblastic osteoid tissue and fiber bone. (Dog 60, low calcium without vitamin D.) (Spec. 1789, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 58 cm.; ×40.)

Bony labyrinthine capsule: The stapes was normal, but the bone in the immediate vicinity of the circular ligament showed considerable change. There was enlargement of the haversian canals and resorption. In the cavities, reticulated and fibrous marrow and some lymphatic marrow with hemorrhages was noted. form of fibroblastic osteoid tissue were noted. The osteoid tissue was similar to that found in rickets, but the increased resorption process indicated that this was not true rickets. We were dealing with pseudorickets (Christeller).

Internal organs: There were occasional foci of necrosis in the liver.

Summary of the bone changes: Extensive resorption paralleled by new formation in approximately equal amounts was present. The newly formed bone consisted mostly of osteoid tissue.

Diagnosis: Generalized osteodystrophia fibrosa with pseudotumors and cysts in the jaws (ostitis fibrosa von Recklinghausen, so-called pseudorickets, Christeller) was diagnosed.

Dog 85.—The low calcium salt mixture without cod liver oil (neutral diet 11a) was fed seven months, when the animal died of intercurrent disease. Since the dog was so long on this diet, the findings should be considered here, although they cannot be accepted unconditionally.

General osseous system: Osteochondral junction of the ribs, internal. A few vessels were seen within the cartilage. There was no new formation of lamellar bone in the resorption cavities, and the epiphyseal line was slightly bent. The arrangement of the cartilaginous columns was slightly disturbed. The epiphyseal plate was regularly opened. A few giant cells were seen in the subchondral tissue. Reticulated marrow and hemorrhages were noted. There was almost no apposition on the cartilaginous remnants, which were stretched to a marked degree.

Osteochondral junction of the ribs and long bones, external. Resorption, a few giant cells and fibrous tissue in the cavities were noted. There was no apposition on the external surface.

Fig. 41.—Bony labyrinthine capsule; resorption cavities; destruction of endosteal layer; fibrous marrow, giant cells, new formation of osteoid tissue. (Hypo-ostotic porotic form of osteodystrophia fibrosa.) (Dog 60, low calcium without vitamin D.) (Spec. 1789-5, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 57 cm.; ×109.4.)

Cortex of the long bones: A cross-section was made through the center of the diaphysis of the femur. In the large marrow cavities, there were fat marrow and marrow hemorrhages. The bone of the cortex was extremely softened.

In the cavities, there were reticulated marrow, lymphatic and fat marrow. No giant cells and no osteoid tissue were noted. On the external surface of the cortex, there were giant cells, fibrous tissue and isolated subperiosteal hemorrhages. There was no new formation of bone.

Tooth system: This was not examined.

Bony labyrinthine capsule: The stapes was normal. The capsule was extremely softened. A few giant cells, reticulated marrow, hemorrhages, a little new formation and osteoid tissue were noted.

Internal organs: Bronchial pneumonia was the cause of death. Occasional foci of necrosis were found in the liver.

Summary of the bone changes: There was almost no apposition, with slightly increased resorption of bone.

Diagnosis: True osteoporosis (scurvy-like) was diagnosed.

Dog 62.—The low calcium salt mixture without cod liver oil (basic diet 11a) was fed. Since this animal was on this diet for only one and one-half months and died of an intercurrent disease, the findings can be accepted only conditionally.

General osseous system. This was not examined.

Tooth system: The calcification of the dentin was poor. The odontoblastic layer was found in a stage of degeneration. There were hemorrhages in the pulp.

Paradentium: The alveolar bone showed increased destruction by giant cells, paralleled by new formation of fibroblastic osteoid tissue. Fibrous marrow was noted. The gingiva was inflamed.

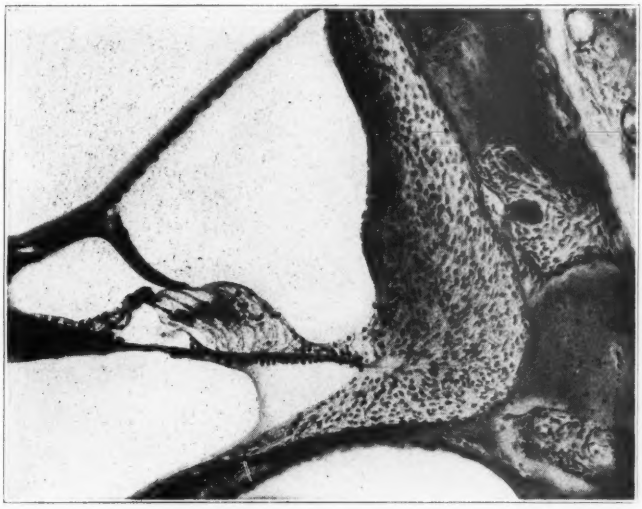

Fig. 42.—Hypo-ostotic porotic form of osteodystrophia fibrosa; destruction of labyrinthine capsule. There is apposition of osteoid tissue in the lower resorption cavity. (Dog 60, low calcium without vitamin D.) (Spec. 1789-35, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 70 cm.; ×134.)

Bony labyrinthine capsule: The stapes was normal. There was considerable softening of the cortex of the labyrinthine capsule.

In the cavities were many giant cells, reticulated marrow and osteoblasts in rows. A wide band of osteoid tissue was noted.

Internal organs: There was fatty degeneration of the tubules of the kidney, with albumin in the glomerular spaces. The cause of death was nephritis.

Summary of the bone changes: There was increased resorption with a large amount of apposed tissue, mostly osteoid.

Diagnosis: Pseudo-osteomalacia (hypo-ostotic porotic form of osteodystrophia fibrosa) was diagnosed.

Dog 59.—The low calcium salt mixture, without cod liver oil (basic diet 11a) was fed four and one-half months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. There were few vessels within the cartilage. No new formation of lamellar bone was noted in the resorption cavities. The epiphyseal line was slightly bent, the arrangement of the cartilaginous columns slightly disturbed, the epiphyseal plate irregularly opened. There were many giant cells and fibrous marrow in the subchondral tissue. A moderate amount of apposition on the cartilaginous remnants was noted. The newly formed bone consisted partially of fibroblastic osteoid tissue, fiber bone and lamellar bone. Osteoblasts were noted in rows, but there was no apposition of lamellar bone.

Osteochondral junction of the ribs and long bones. In those places where the cartilage was still present, marked regenerative processes were visible. On the

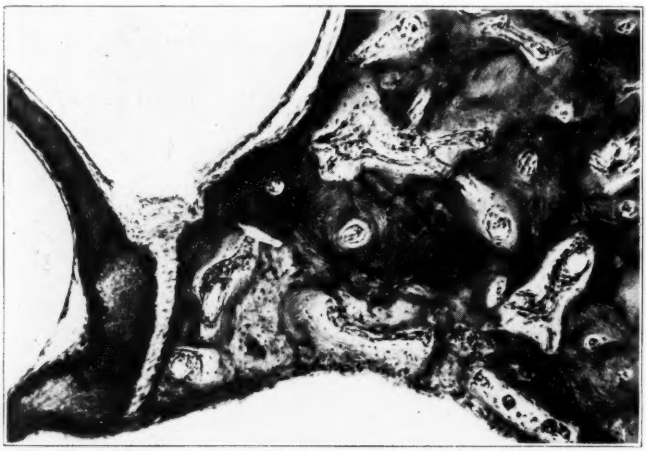

Fig. 43.—Hypo-ostotic porotic form of osteodystrophia fibrosa; resorption and new formation of bone (osteoid). There are resorption cavities near the ligamentum circulare. (Dog 60, low calcium without vitamin D.) (Spec. 1789-50, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 44 cm.; ×84.)

external surface, resorption and many giant cells were seen.

In the cavities, there was fibrous tissue. Very little apposition was seen. The newly formed material consisted of fibroblastic osteoid tissue and fiber bone. They were separated from the old bone by a cementum line. Islands of fibroblastic bone were noted. There were no subperiosteal hemorrhages.

Cortex of the long bone. A cross-section was made through the center of the diaphysis of the femur. In the large marrow cavities, fat and lymphatic marrow was seen. There were no marrow hemorrhages. The bone of the cortex was slightly softened. In the cavities, reticulated marrow, fibrous marrow, with few giant cells and a thin osteoid seam were noted.

On the external surface of the cortex were giant cells. Fibrous tissue was noted. There were no subperiosteal hemorrhages. New formation of fibroblastic osteoid and fiber bone separated from the old bone by a cementum line were noted. There were islands of newly formed fiber bone and osteoblasts in rows, but no distinct new formation of lamellar bone.

Skull. This was softened throughout.

In the cavities, fibrous marrow and new formation of fiber bone, frequently in the form of islands, were noted. Toward the outside there was new formation of fiber bone on the old cortex (osteophyte, hyperostotic form).

Fig. 44.—Endosteal layer of labyrinthine capsule; osteolysis (?) of old bone. (Dog 60, low calcium without vitamin D.) (Spec. 1789-10, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 4 mm.; eyepiece 8x; extension of camera 38 cm.; ×38.)

Tooth system: The dentin showed poor calcification. The odontoblastic layer was found in a stage of degeneration. Single hemorrhages in the pulp and a thickened dentinoid layer were noted.

Paradentium: Continual destruction and rebuilding processes were extremely active in the whole alveolar bone. The original bone had already been entirely resorbed and replaced by a poorly calci-

fied fiber bone. The marrow cavities were filled with hemorrhages or fibrous tissue. Cysts, both large and small, were to be found everywhere, some of these with and others without endothelial membrane. Some of the cysts were filled with blood and others were not. The structure of the peridental membrane was already entirely lost. Everywhere extensive resorption by osteoclasts was evident. The gingiva showed much subepithelial infiltration, with granulation tissue formation.

Bony labyrinthine capsule: The stapes was normal; the capsule extremely softened. In the cavities were reticulated marrow, fibrous tissue, giant cells, osteoid tissue and osteoblasts.

Internal organs: Glomerulonephritis and tubular degeneration of the kidneys were found.

Fig. 45.—Subchondral region of costochondral junction of right fifth rib; no apposition of bone on cartilaginous remnants; many giant cells; reticulated and lymphoid marrow; diagnosis, true osteoporosis. (Dog 85, low calcium without vitamin D.) (Spec. 3032, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 51 cm.; ×98.)

Summary of the bone changes: There was a large amount of apposition with increased resorption. In certain places, this new formation exceeded the normal

and the amount of resorption (hyperostotic porotic form, pseudotumor).

Diagnosis: Generalized osteodystrophia fibrosa, with pseudotumors and cysts in the jaw (hyperostotic porotic form in the skull, pseudorickets), was diagnosed.

Dog 83.—The low calcium salt mixture without cod liver oil (basic diet 11a) was fed eight and one-half months, when the animal was killed.

General osseous system: Osteochondral junction of the ribs, internal. A few vessels were noted within the cartilage. There was no apposition of lamellar bone in the resorption cavities. The epiphyseal line was straight; arrangement of the cartilaginous columns disturbed; the epiphyseal plate regularly opened. Many giant cells were noted in the subchondral tissue. Subchondrally, there were fibrous marrow, reticulated marrow and hemorrhages. Extensive apposition was noted on the cartilaginous remnants. The apposed bone was fibroblastic osteoid and fiber bone. The osteoblasts were in rows, but there was no marked apposition of lamellar bone.

Osteochondral junction of the ribs and long bones, external. Resorption, giant cells in the cavities, fibrous tissue and little apposition were noted. The newly formed material consisted of fibroblastic osteoid tissue and fiber bone, a part of which was of inferior quality. It was separated from the old bone by a cementum line. Single subperiosteal hemorrhages were noted.

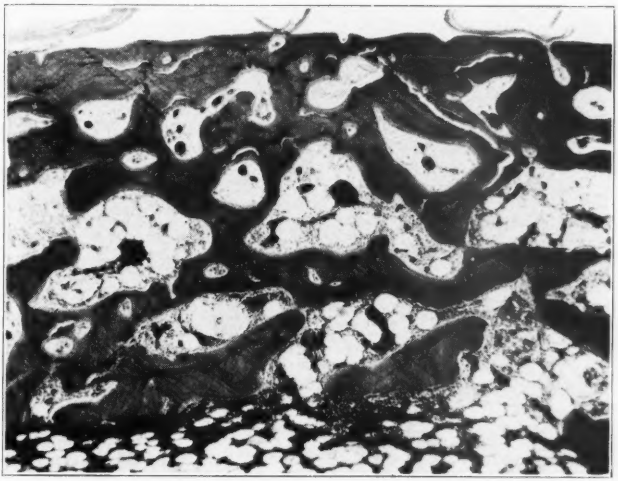

Fig. 46.—Cross-section of femur, diaphysis; severe osteoporosis; large resorption cavities filled with fat marrow. (Dog 85, low calcium without vitamin D.) (Spec. 3029, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 4x; extension of camera 67 cm.; ×46.)

Cortex of the long bones. A cross-section was made through the center of diaphysis of the radius and ulna. In the large cavities, fat and lympathic marrow and extensive marrow hemorrhages were seen. The bone of the cortex was extremely softened. In the cavities were

reticulated marrow, fibrous marrow, many giant cells, a small amount of osteoid tissue. On the outside of the cortex were giant cells, fibrous tissue and single subperiosteal hemorrhages. New formation of fibroblastic osteoid tissue and fiber bone, which is separated from the old bone by a cementum line, was noted. On the external surface, there were no osteoblasts in rows and no apposition of lamellar bone was seen.

Skull. In a number of places, there was subperiosteal softening of the bone. In the cavities, fibrous marrow and new formation of fiber bone were noted.

Paradentium: The upper and lower jaws showed the same extreme changes as in dogs 76, 60 and 59. The original alveolar bone had already disappeared entirely, being replaced by new fiber bone and fibroblastic osteoid tissue. Osteoclasts rule the picture. The tissue meshes were filled with blood, hemosiderin and fibrous marrow. In the region of the molars, parallel with the area of bone resorption, this resorption extended deep into the

Fig. 47.—Longitudinal section of right tibia, distal epiphyseal line; reticulated marrow, fibrous marrow, giant cells, osteoblasts, relatively heavy deposit of bone on cartilaginous remnants. The epiphyseal line is irregular. (Dog 59, low calcium without vitamin D.) (Spec. 1771, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 44 cm.; ×85.)

dentin of the roots. The resorption cavities were filled with newly formed but poorly calcified bone. The real structure of the periodental membrane was no longer visible. The gingiva showed a high degree of subepithelial round-cell infiltration and granulation tissue formation.

Bony labyrinthine capsule: The stapes was normal, the capsule extremely softened. In the cavities were reticulated marrow, giant cells, osteoblasts in rows and a wide band of osteoid tissue.

Fig. 48.—Section of right ulna, subchondral region, outside; islands of hyaline tissue (malformed fiber bone), giant cells, fibrous marrow, new formation of fibroblastic osteoid and fiber bone; typical osteodystrophia fibrosa. (Dog 59, low calcium without vitamin D.) (Spec. 1770A, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 44 cm.; ×85.)

Internal organs: These were not examined.

Summary of the bone changes: The excessive amount of resorption with parallel apposition exceeded the resorption processes only in the jaws. A large amount of osteoid tissue was present.

Diagnosis: Generalized osteodystrophia fibrosa with pseudotumors and cysts (jaws), osteitis fibrosa von Recklinghausen (so-called pseudorickets, Christeller), was diagnosed.

COMMENT

From the foregoing data, it can be seen that several diseases with distinctly differentiated characteristics are found which are invariably produced by a definite diet. (Table 5.)

1. All animals (dogs 46, 21, 48, 20, 44) which were fed diet 4 (normal salt mixture with cod liver oil) showed a very slight osteoporosis with a healing tendency. These animals were considered practically normal and were the controls for the remainder of the experimental animals.

2. All animals (dogs 41, 26, 43, 24, 30, 42) fed diet 4a (normal salt mixture

TABLE 5.—RESULTS FROM DIETARIES CONTAINING NORMAL SALT MIXTURE AND LOW CALCIUM SALT MIXTURE

Normal Salt Mixture		Low Calcium Salt Mixture	
Diet 4	Diet 4a	Diet 11	Diet 11a
With Cod Liver Oil	Without Cod Liver Oil	With Cod Liver Oil	Without Cod Liver Oil
46 Slight osteoporosis with apposition (practically normal)	41 Slight osteoporosis with healing tendency (healing scurvy, osteodystrophia fibrosa?)	76 Generalized ostitis fibrosa (von Recklinghausen) with pseudotumors and cysts	60 Generalized osteodystrophia fibrosa with pseudotumors and cysts in jaws
48 Slight osteoporosis with apposition (practically normal)	43 True osteoporosis		85* True osteoporosis
44 Slight osteoporosis with apposition (practically normal)	42 Slight osteoporosis		59 Generalized osteodystrophia fibrosa with pseudotumors and cysts in jaws; hyperostotic porotic form in skull
21 Slight osteoporosis with healing tendency (practically normal)	26 Osteoporosis with healing tendency (healing scurvy?)		62* Pseudo-osteomalacia
20* Slight osteoporosis with apposition (practically normal)	30 Practically normal		83 Generalized osteodystrophia fibrosa with pseudotumors and cysts in jaws
	24 Osteoporosis with healing tendency (scurvy?)		

*Death due to intercurrent disease.

without cod liver oil) showed osteoid tissue in the jaw bone, with the exception of dog 42; while in only dogs 41 and 43 did this osteoid tissue occur in the general osseous system.

On the other hand, all animals developed osteoporosis, The osteoporosis in dog 30 was so slight that this animal may be considered as normal. It was 4 months old when the experimental work was started, had previously lived outdoors and had undoubtedly passed the crucial period of its bone growth. An osteoporosis with a healing tendency resulting in a picture

Fig. 49.—Section of ulna; hyperostotic porotic form of osteodystrophia fibrosa, especially in area of former epiphyseal line. There is destruction of original bone and formation of new bone in the form of an external frame work (pseudorickets). (Dog 59, low calcium without vitamin D.) (Spec. 1772A, embedded in parlodion, stained with hematoxylin-eosin; Leitz summar 120; extension of camera 75 cm.; ×5.)

which is similar to the hypo-ostotic porotic form of osteodystrophia fibrosa was found in dog 41. Why the result in this dog (41) does not conform to the other results in the same group is hard to explain. The difference between dog 41 and the others in the same group may possibly be ascribed to the fact that the former was the only dog in the group having a distinctly acid reaction. Perhaps the biochemical data may give the clue. Of course, in the experiment on this dog, dogs fed a diet containing cod liver oil (diet 4).

All animals fed normal salt mixture diets 4 and 4a, therefore, were the controls for the corresponding experimental group with low calcium salt mixture diets 11 and 11a.

3. All animals that had been kept on diet 11 (low calcium with cod liver oil) died of an intercurrent disease before the completion of the experiment, with the exception of dog 76. This dog during

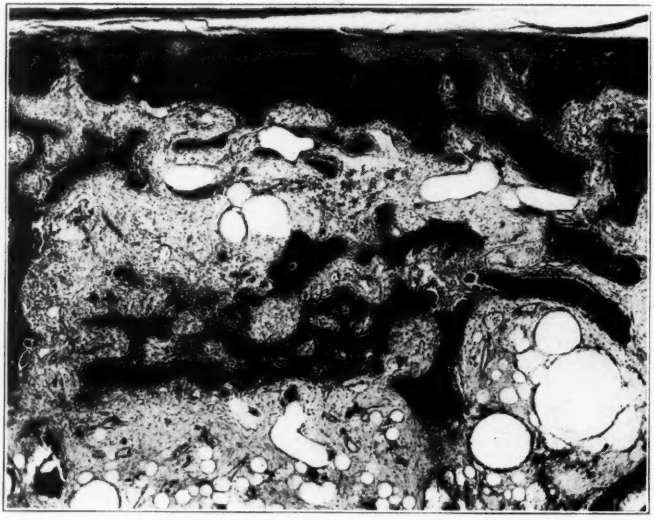

Fig. 50.—Typical osteodystrophia fibrosa in the marrow cavity between tabula externa and interna; fibrous marrow, islands of fibroblastic osteoid, fiber bone, giant cells. (Dog 59, low calcium without vitamin D.) (Spec. 1772B, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 8x; extension of camera 31 cm.; ×42.)

there may have been a source of error, of which we have no knowledge.

A comparative study of the results with the group of animals fed diet 4a shows the following: The complete lack of vitamin D caused an aggravation of osteoporosis. This osteoporosis was present only to a very slight degree in those half of its life was kept for some unknown reason on diet 11a, and can, therefore, in the final analysis, be included in the report of the low calcium diet experiment and compared with the animals on normal salt mixture.

There was, therefore, no dog in the low calcium group which from a strictly

scientific standpoint could serve as a control for the group with lack of Vitamin D. We regret this lack of completeness in this experiment.

Another group of animals fed on this diet could not be included in this experiment because of lack of time, since the work had to be completed at a definite date.

4. The last group on diet 11a (low calcium without cod liver oil) showed very interesting and remarkable results.

These pseudotumors in osteodystrophia fibrosa are known as "brown tumors." Siegmund has proved that the giant cell epulis (intra-osseous epulis) is also such a "brown tumor." He emphasizes especially the fact that the so-called epulis represents the highest degree of an osteodystrophic process. This was also noted by von Recklinghausen.

In our experiments on dogs, we have produced the intra-osseous epulis by means of a generalized metabolic disturbance. On the other hand, according to the latest classification of the "Arbeitsgemeinschaft für Paradentosenforschung" (Weski, Loos) (the group doing research work on paradentosis in Europe), the intra-osseous epulis belongs to the chronic marginal diseases of the paradentium. This intra-osseous epulis is found in this classification under group C

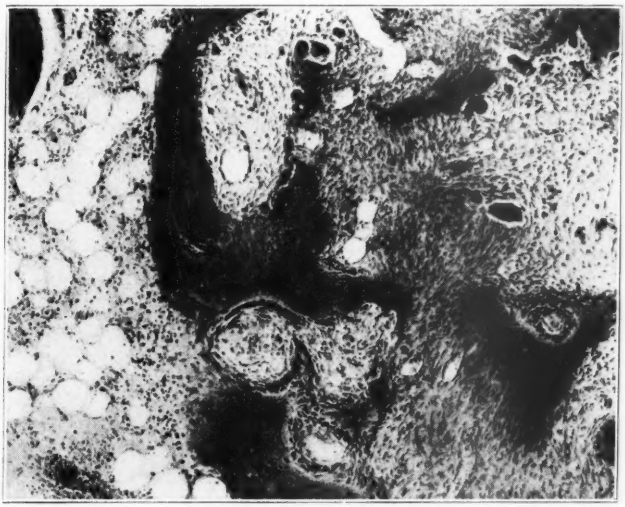

Fig. 51.—Typical osteodystrophia fibrosa in the marrow cavity of the skull. The original fat marrow has undergone transformation into fibrous marrow. (Dog 59, low calcium without vitamin D.) (Spec. 1772A, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 44 cm.; ×85.)

All animals which were under experiment long enough and did not die of intercurrent disease (dogs 60, 59, 83) developed changes which were fundamentally different from all the other groups. *The typical picture of osteitis fibrosa von Recklinghausen has been produced;* the pseudotumors and cysts which are typical of this disease appeared in the jaws.

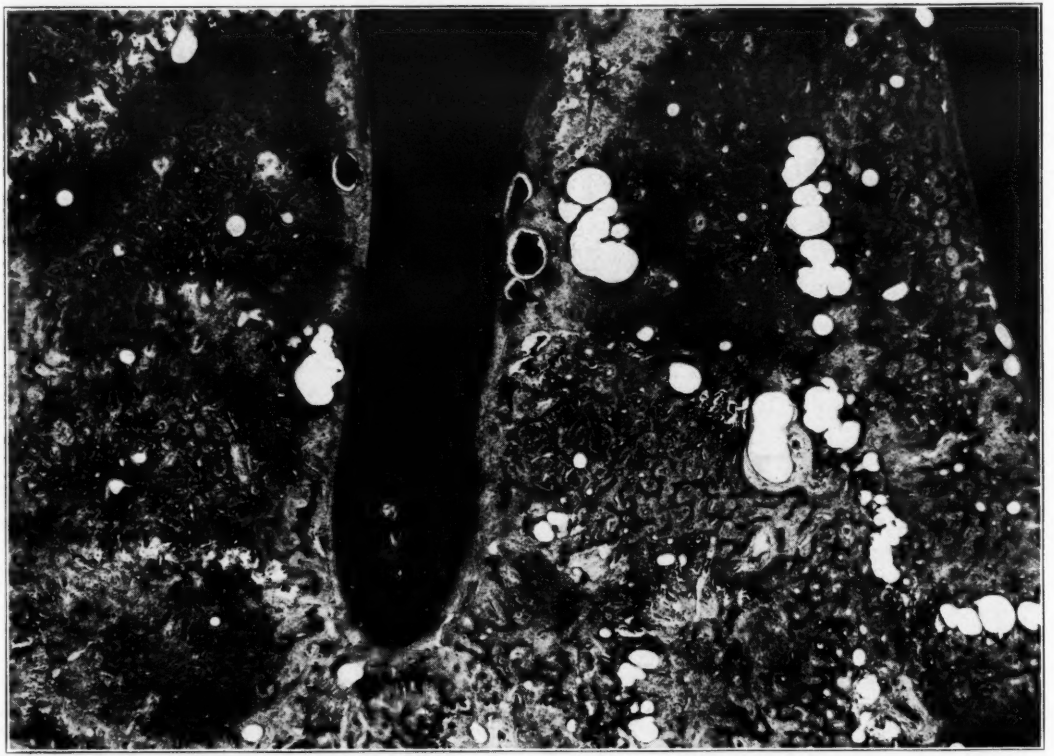

Fig. 52.—Section of tooth; local intensification of generalized hyperostotic porotic form of osteosystrophia fibrosa in the jaw bones (pseudotumor, intra-osseus epulis); giant cells, fibrous marrow, new formation of fibroblastic osteoid tissue and fiber bone, blood-filled mesenchymal sponge, cysts and pseudocysts. There is complete destruction of the original alveolar process and replacement by pathologic bone formation. (Dog. 59, low calcium without vitamin D.) (Spec. 1778, embedded in parlodion, stained with hematoxylin-eosin; Leitz summar 42; extension of camera 75 cm.; ×18.7.)

"Paradentoma" No. 2 as paradentoma central sive myelogenes (localized osteodystrophia fibrosa).

Since in this type of osteodystrophia fibrosa, we are dealing with a pseudotumor and not with a real tumor ("oma"), we would suggest that this form of osteodystrophia fibrosa in the future be grouped with total atrophic paradentosis, i. e., with the genuine forms or dystrophic type of paradentosis.

It has been proved by this experiment that it is possible to produce in the jaws of dogs by *metabolic disturbance* (dystrophy) the pseudotumor which is a manifestation of von Recklinghausen's disease.

The following considerations must be emphasized regarding generalized osteodystrophia fibrosa experimentally produced by a low calcium diet without cod liver oil: In certain respects, these changes resemble those occurring in human rickets. This resemblance is especially noticeable in the wide osteoid seam. It is for this reason that, in similar experiments with dogs (Jones, Mellanby), these changes have been erroneously interpreted as rickets.

Among the discoveries in pathology during the past decade, Christeller formulated the picture of pseudo-osteomalacia, which he believes should be grouped with osteodystrophia fibrosa. Therefore, the changes that we have produced by feeding a low calcium diet without cod liver oil cannot be diagnosed as rickets. In 1926, Christeller made the statement that, up to that time, true rickets had not been observed in dogs. Such

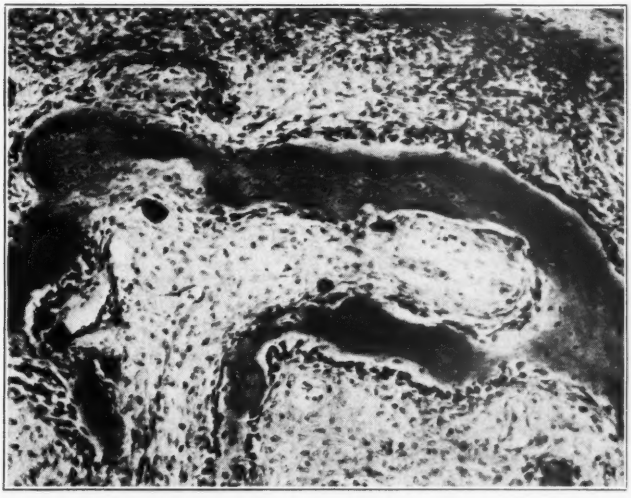

Fig. 53.—Alveolar process, below the apex of a molar; young mesenchymal tissue, fibrous marrow, giant cells, resorption, osteoblasts, new formation of bone (osteoid tissue); diagnosis: pseudo-osteomalacia, i.e., a hypo-ostotic porotic form of osteodystrophia fibrosa. (Dog 62, low calcium without vitamin D.) (Spec. 1072, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 67.5 cm.; ×129.6.)

bone formation. (Dog 59, low calcium without vitamin D.) (Spec. 1778, embedded in parlodion, stained with hematoxylin-eosin; Leitz summar 42; extension of camera 75 cm.; ×18.7.)

extreme resorption processes are foreign to true rickets.

Since we have no control animals fed with cod liver oil for these dogs (diet 11a), it is not possible to show what rôle vitamin D plays in the production of this disease. It is interesting to observe that dog 76, which was fed for three months

Fig. 54.—Resorption cavity within labyrinthine capsule. Osteoid margins are to be noted in upper part of picture. Diagnosis: pseudo-osteomalacia, i.e., a hypo-ostotic porotic form of osteodystrophia fibrosa. (Dog 62, low calcium without vitamin D.) (Spec. 1069-50, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 43 cm.; ×82.6.)

on diet 11 as well as for three months on diet 11a, also developed an osteodystrophia fibrosa with pseudotumors and cysts. The spontaneous development of such a disease in a dog was noted and described by Weber in 1929. The animal referred to by him in his article had been fed exclusively with Spratt's Fibo and tea, and it was supposed at the time that the dog's death was due to a nutritional deficiency. Our experiments may furnish the proof of the theory. As none of the animals which were fed with normal salt mixture either with or without cod liver oil show such changes, this may indicate that the fundamental cause of osteodystrophia fibrosa lies in a calcium deficiency in the diet. If this is so, it would further indicate that osteodystrophia fibrosa probably should be placed in the large group of calciprivative oseopathies. A histologic classification of this disease has been given by Christeller (malacic bone disease).

The different reactions of the food in the two salt-mixture groups appeared to be without influence.

Aside from true osteoporosis and osteodystrophia fibrosa, in several dogs extensive hemorrhages have been observed. These hemorrhages result in a histologic picture which resembles that of scurvy when conjoined with true osteoporosis and *healing scurvy* in the presence of new bone apposition.

Subperiosteal and marrow hemorrhages have been found in the following dogs: 46, 20, 41, 26, 30, 24, 76, 60, 85, 83. Hemorrhages in the pulp, and especially in the odontoblastic layer were found in all dogs under experiment. It is singular that hemorrhage could not be found in dogs which have been kept on diet 4a (normal salt mixture without cod liver oil). The question remains open as to whether the hemorrhages may be laid to the diet, to the method of killing the animals (chloroform) or to the preparation

of the specimens. It is improbable that we are dealing with scurvy-like changes resulting from a deficiency of vitamin C in the diet because these dogs received a daily dose of 3 gm. of lemon juice. Perhaps, biochemical data covering these animals may offer some explanation. At any rate, it is known that scurvy also belongs to the osteosis group (Fig. 59) and that there are border line cases between true forms which cannot be sharply differentiated histologically. On the other hand, it may be emphasized that there is a certain relationship between paradentosis and scurvy (Hanke).

The foregoing results have made it possible to disclose for the first time *a relationship between the alveolar process and the general osseous system and also to recognize the involvement of the labyrinthine capsule in generalized bone disturbances.*

The analysis of the material has led to the following general conclusions:

1. In every case, the alveolar process was involved in the same sense as the general osseous system. In fact, the changes in the bony part of the paradentium were more extensive than in the general bone system. This observation may be traced back to the traumatic influence of the occlusion, especially for the development of the brown tumors in the region of the jaws.

2. The labyrinthine capsule was changed in the same sense as the whole bone system and the alveolar process. As contrasted with the alveolar process, the changes in the labyrinthine capsule were not so marked as in the general system.

Fig. 55.—Pseudo-osteomalacia of labyrinthine capsule. The large osteoid margins and resorption by giant cells are to be noted. Diagnosis: hypo-ostotic porotic form of osteodystrophia fibrosa. (Dog 62, low calcium without vitamin D.) (Spec. 1069-55 embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 58 cm.; ×111.)

3. The influence of diet showed more markedly in the alveolar process than in the labyrinthine capsule.

THE PARADENTOSIS PROBLEM

What effect will these conclusions have on the whole paradentosis problem? The paradentium consists according to Weski of four parts: (1) epithelium, (2) cementum, (3) peridental membrane and (4) bone. The involvement of all four organs at the same time represents the typical picture of paradentosis (pyorrhea).

1. *Epithelium.*—In all animals under experiment, inflammatory infiltration in the gingiva was found. This round-cell infiltration was proportionately small in those animals on a normal salt mixture diet plus cod liver oil. In a very few cases, formation of a subepithelial granulation tissue had taken place, while the surface epithelium was still intact. Pyorrheic symptoms were not observed in this group of animals. In those animals which did not receive cod liver oil in addition to the normal salt mixture diet, the inflammatory symptoms in the region of the gingiva were more pronounced, but, as in the previous case, the surface epithelium was unaffected.

It is remarkable that the enamel epithelium, i. e., the epithelial attachment, in this latter group was partially degenerated at the cemento-enamel junction, as well as half way between this point and the free margin of the gum; an observation which could not be made in any other group. The importance for dentistry of these experimental changes will be discussed in greater detail in a future communication.

In the low calcium group, the subepithelial changes were similar to those of the group fed the normal salt mixture

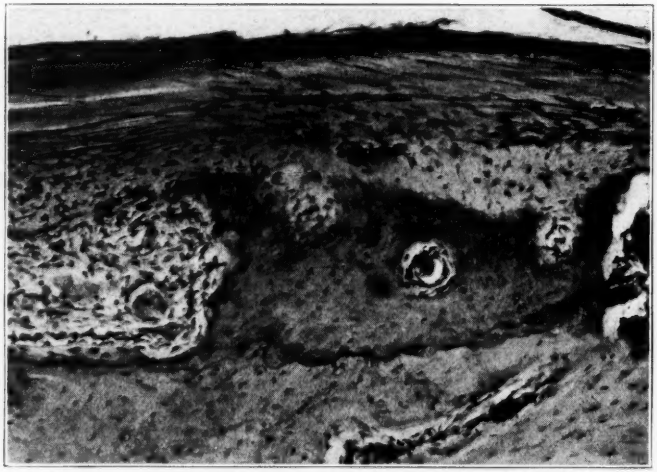

Fig. 56.—Section of radius, bone structure below periosteum; resorption (cementum line), new formation of bone (fiber) with osteoid margins (fibroblastic osteoid). (Dog 83, low calcium without vitamin D.) (Spec. 3009-4, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 8x; extension of camera 38 cm.; ×147.)

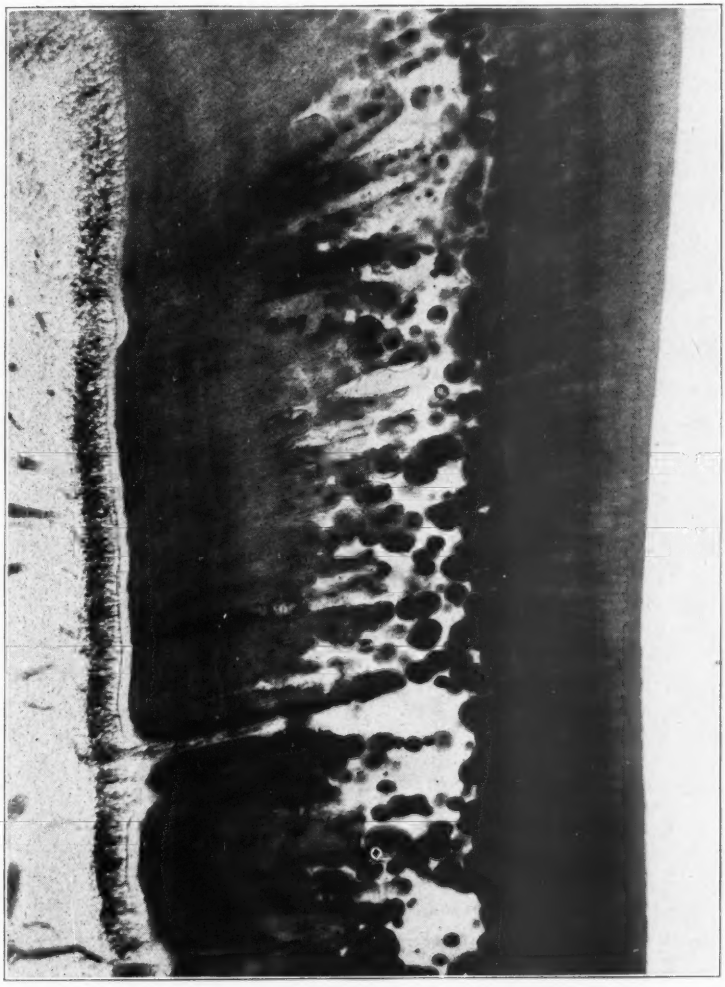

Fig. 57.—Section of tooth; poor calcification of dentin. Interglobular spaces and odontoblasts enclosed in dentoid tissue are to be noted. (Dog 83, low calcium without vitamin D.) (Spec. 2025A, embedded in parlodion, stained with hematoxylin-eosin; Leitz objective 1b; eyepiece 8x; extension of camera 60 cm.; ×82.5.)

but without cod liver oil. No differences worthy of remark could be found. The fact that marked pyorrheic symptoms did not develop in any case in these two groups may be explained by the facts that all the animals were comparatively young and the duration of the experiment was too short.

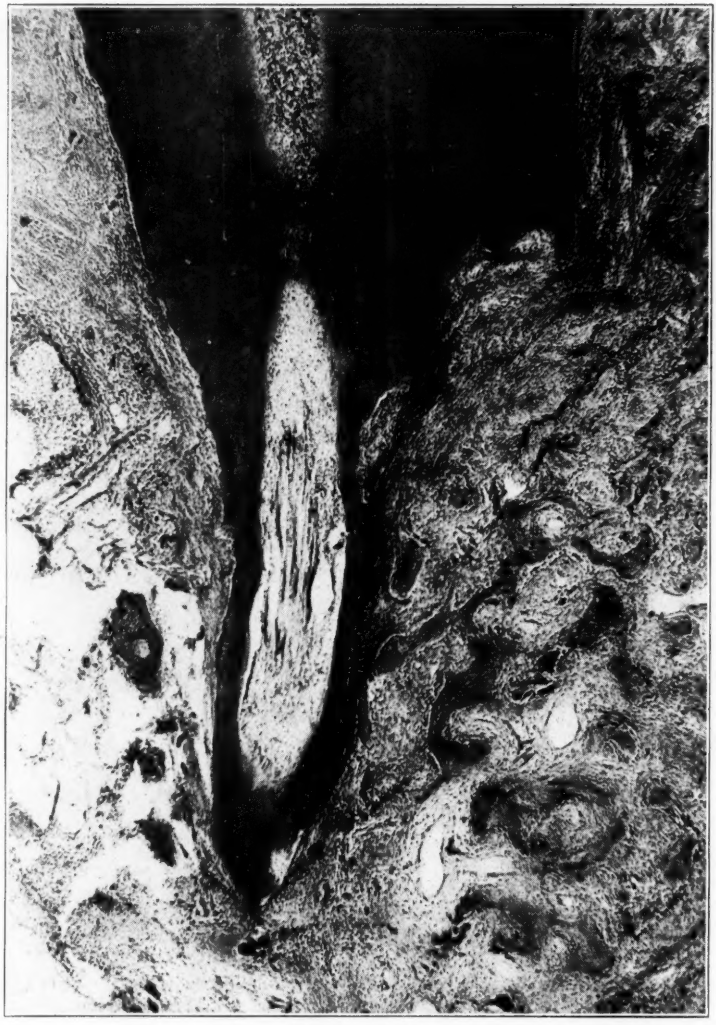

Fig. 58.—Section of root of a lower molar in the stage of resorption; complete disappearance of original alveolar bone; giant cells, young mesenchymal tissue, fibrous tissue, islands of fibroblastic osteoid and fiber bone; partial picture of pseudotumor (intra-osseous epulis) showing the picture of osteodystrophia fibrosa (Dog 83, low calcium without vitamin D.) (Spec. 2027, embedded in parlodion, stained with hematoxylin-eosin; Leitz apochromatic 16 mm.; eyepiece 4x; extension of camera 80 cm.; ×153.)

2. *Cementum.*—The cementum showed extensive resorption in several places with apposition of secondary cementum in both the animals on the normal salt mixture without cod liver oil and low calcium diets. In the present state of our knowledge of the apposition and resorption of cementum, the question as to whether the resorption observed in these two groups may be developed through the influence of diet must remain unsolved, especially since resorption could not be found in every dog nor on every tooth in any one dog. It is to be remarked that the cementum resorption is more frequently found in the two groups under discussion than in the group of animals receiving the normal salt mixture plus cod liver oil.

The dogs in which the typical picture of an osteodystrophia was produced showed extreme resorption extending deep into the roots of the teeth. These pictures resemble those which have been published recently by Mueller and Simonton. It seems to us that, in those cases in which no bone changes are reported in detail, they are dealing with a systemic disease. It may be that these are cases of osteodystrophia fibrosa similar to the changes mentioned above.

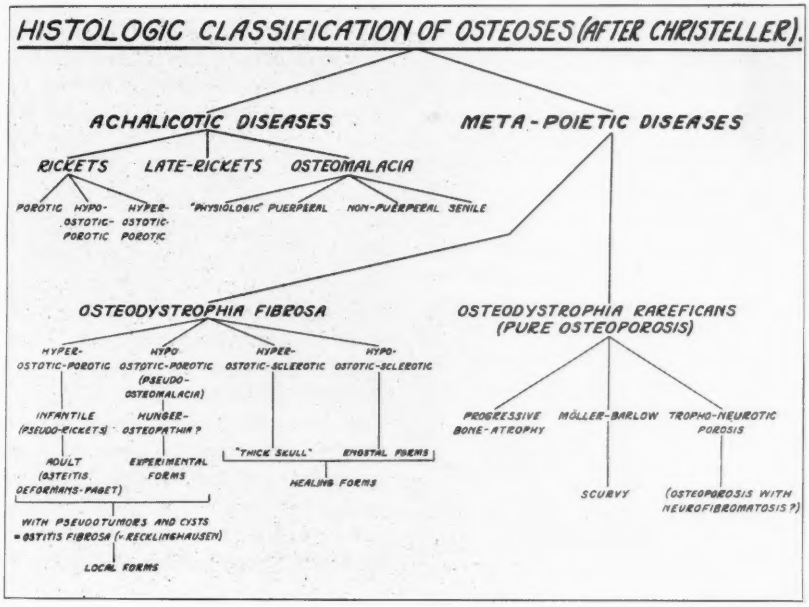

Fig. 59.—Histologic classification of osteoses.

3. *Peridental Membrane.*—Extensive thickening of the peridental membrane corresponding to the osteoporotic resorption of the limiting alveolar process was frequently found. This explains the loosening of the teeth, which was to be observed clinically. In those cases in

which the alveolar process was extensively destroyed by the osteodystrophic process, large cysts partially filled with blood were found in the peridental membrane. In other cases, the peridental membrane was hardly recognizable because of the resorptive process on the one side and the entirely irregular bone formation process on the other.

4. *Bone.*—The bone changes have already been fully discussed.

Inflammatory changes in the region of the gingiva of those dogs under experiment are not to be explained as a primary paradentitis, i. e., developing as a result of calcareous deposits, food remnants, etc. We are dealing fundamentally with a lowering of the resisting power of the whole organism as a consequence of unbalanced diet. Using this unbalanced diet, we find not only severe primary changes of the alveolar process, but resulting from these are secondary changes of the cementum, the peridental membrane and the epithelium or the subepithelial tissue.

Our findings indicate that these changes must be referred to a chronic metabolic disturbance caused by an unbalanced diet. Three different forms of genuine paradentosis have been produced in dogs: (1) a true osteoporotic form; (2) two osteodystrophic forms: (*a*) a hypo-ostotic porotic form of osteodystrophia fibrosa and (*b*) a hyperostotic porotic form of osteodystrophia fibrosa; and (3) a scorbutic form.

All of these experimentally produced forms of paradentosis show an involvement of the entire osseous system. It has been clearly proved that these forms of paradentosis in dogs are the expression of a general metabolic disturbance.

Since we have succeeded in producing experimentally in dogs several distinct forms of paradentosis, it should be possible also to differentiate by analysis various forms of genuine or dystrophic paradentosis in human beings. This question is of the greatest importance to clinical dentistry. We have clinical evidence of the origin of the forms of paradentosis which we have produced and, in the light of our experiments, should be able to treat them clinically, that is, by means of calcium and cod liver oil. The dentist working on human beings faces great difficulties in applying the correct therapy. A form of treatment can be considered successful only if it eradicates both the symptoms and the cause of the disease. Therefore, it is absolutely necessary that the dentist endeavor to find the cause of each type of paradentosis. In order to accomplish this, he must be able to diagnose it. First, he must be able to distinguish between true and secondary paradentosis (Becks). If true paradentosis is diagnosed, not only should the question of calcium and vitamin D deficiency in the food be considered, but also systematic search must be made for other possible causes. These may vary in every case (diabetes, pregnancy, glandular diseases, etc.). Whether identical causative factors are concerned in all cases of true paradentosis cannot be stated at the present time. After the elimination of the inflammatory type of paradentosis, it would seem advisable to study carefully the previous history of the patient and to make a clinical examination of the whole organism and especially a biochemical examination of the body fluids in order to determine the origin of the disturbance. In many cases, the previous history alone will suggest the tentative preliminary treatment. One thing is certain: Paradentosis is a general medical problem and its solution requires medical thought.

OTOLOGIC CONSIDERATIONS

Examination reveals the fact that the changes in the bony labyrinthine capsule were identical with those of the general osseous system and the alveolar process, but they were less extensive. In those forms of osteodystrophia fibrosa in which a brown tumor was found in the jaw (hyperostotic porotic form) a hypoostotic porotic form of osteodystrophia fibrosa was developed in the labyrinthine capsule. Therefore, the experimental production of osteoporosis and osteodystrophia fibrosa of the labyrinthine capsule in dogs has been accomplished.

It is known that otosclerosis may develop on the basis of a generalized osteodystrophia fibrosa. The bone picture of otosclerosis is similar to that of a local osteodystrophia and, in its typical form (as hyperplasia), closely resembles brown tumor (hamartoplasia, Weber). Otosclerosis has been called the epulis of the petrous portion of the temporal bone (Weber). According to this statement, the successful attempt to produce otosclerosis experimentally should result in the development of a localized hyperostotic porotic or sclerotic form of osteodystrophia fibrosa in hypersusceptible typical areas in the labyrinthine capsule (e. g., vicinity of oval window and stapes). Otosclerosis was not produced in the foregoing experiments. The reason for this will be discussed in a future paper.

The importance of our studies as regards the problem of otosclerosis may be summarized as follows: It has been shown that:

1. A generalized osteodystrophia fibrosa can be produced by a low calcium diet without cod liver oil.

2. A generalized osteodystrophia fibrosa can be produced in the labyrinthine capsule.

3. It is possible to produce brown tumors experimentally. In our experiments, these brown tumors were developed in the jaws probably on account of a mechanical irritation in the area affected. In the remainder of the bony system of several animals, a hyperostotic porotic form of osteodystrophia has been developed, but it did not culminate in the formation of brown tumors. A discussion of the possibility of producing brown tumors experimentally in the labyrinthine capsule has been published elsewhere (Weber).

This paper is the result of several years of experimentation. The material investigated is so comprehensive and the results are so manifold that it is the intention to make a detailed study of various problems of special interest which are related to this experiment.

CONCLUSION

It should be emphasized that the histologic investigation of this material has been conducted purposely without a knowledge of the biochemical results in order that our judgment in making the diagnosis might not in any way be biased. The biochemical results will be of diagnostic value in this experiment only if they bear a certain definite relationship to the histologic findings. It is our opinion that the bone changes (osteodystrophia fibrosa and osteoporosis) produced by diet cannot be definitely diagnosed by biochemical analyses. The rôle of the biochemist in this problem is, of course, to ascertain whether definite biochemical changes of the body fluids accompany the changes which can be diagnosed clinically and anatomicopathologically. If the biochemical aspect is distinct for each disease thus diagnosed, the biochemical results themselves will be of the greatest value. If no definite relationship can be shown

to exist between the biochemical analysis and those histologic findings upon which we have based our diagnoses, the former, although of some interest, will probably prove to be without value in the diagnosis of these bone diseases.

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FUNDAMENTAL ECONOMIC FACTORS IN DENTISTRY*

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AN examination of recent dental literature discloses the fact that there is a growing interest among dentists in the economics of the dental profession. Because of its many interesting angles and difficult problems, it presents a real challenge for solution. A comprehensive outline taking in all of the topics related to dental economics would just about include everything that is known about dentistry. Each operation and procedure in dentistry has its economic as well as its professional aspect. Then, too, such major matters as the relation between dentistry and medicine, the place of the dental specialist in the economic scheme, and the civic and social relationships of the dentist, as well as the question of the economic status of the industrial dental clinic, the school clinic and the dental clinic supported by the public funds, are all important parts of a complete discussion. Obviously, a consideration of these closely related subjects cannot all be included in a brief paper.

Furthermore, if fundamental facts are to be dealt with, it will be impossible to include any extended practical hints on the conduct of office practice and management, such as are usually given in a paper on dental economics. These considerations are part of a much more detailed discussion and will therefore be referred to only casually in this paper.

Because the whole problem of earning an adequate competence in the practice of dentistry presents many details and facts, it does not necessarily follow that it is impossible of partial solution by every capable dentist. And yet such a cloak of mystery has been thrown around it that those dentists who are not prospering materially as they had hoped are often deluded into the belief that the acquisition of some magic formula, which may supposedly be acquired in a few days, will change defeat into victory. The whole question, in my opinion, involves a knowledge of service rather than accountancy or high powered sales psychology, and before I have finished I trust that you will agree with this premise.

QUALIFICATIONS FOR SUCCESS IN DENTISTRY

As members of the dental profession, we are privileged to serve mankind. To the extent that we succeed in serving, we may consider ourselves as succeeding in the profession. He who truly serves succeeds. Since this is true, any attempt to analyze professional and economic success in dentistry must include a discussion of the fundamental qualifications that affect the degree to which it is possible for any individual dentist to serve the public. In my opinion, these major qualifications are two in number.

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1. The dentist must have acquired an adequate knowledge of the science and art of his profession and must keep his wisdom fresh and up-to-the-minute by means of study in some form. This qualification may be acquired initially at the dental school which gave him his undergraduate training, and, later, by means of systematic reading of professional and scientific literature, by engaging in further study under proper educational auspices and by attending dental society meetings such as this, the seventy-second meeting of the American Dental Association.

2. The dentist must possess the natural personal qualifications, both physical and mental, which will enable him to engage in a vocation in which his every action is subjected to rigorous and intimate inspection and in which each error in judgment and each lapse of the rules prescribing honesty, understanding, cleanliness, thoroughness, accuracy and poise, as well as each departure from scientific and common sense procedure, is noted immediately and penalized. These personal qualifications are largely inherent in the individual, although, of course, some of them may be directed and modified by education and experience. They might be referred to as natural aptitudes.

Obviously, the highest degree of professional success is limited to those who most nearly meet these requisites of knowledge and personal qualifications.

ECONOMIC DIFFICULTIES OF THE DENTIST

The dentist of today is undoubtedly confronted with a number of economic difficulties. Many of these difficulties are not confined to dentistry alone, but are shared in common with other lines of human activity. For example, there are fluctuations in the prosperity of the country due to problems of production, distribution and nonemployment, which have their serious effects on the ability of the public to purchase. A person lacking the funds with which to employ professional service obviously often must do without it until the economic pendulum swings the other way. At the present time, it is coming to be generally recognized that the recovery of business in general from the effects of the sharp decline in the prices of stocks last fall will be a much more gradual process than at first had been visualized. Professional men as well as business men must expect to experience the effects of the period of depression such as we passed through early this year and from which we are just beginning to recover.

Another difficulty is the national custom of making purchases on the installment plan. Installment buying is merely a temporary stimulant to business; its effects are likely to be disastrous in the long run when it is indulged in by the entire nation. In fact, this is, I believe, one of the most important causes for the present business depression. Installment buying began as a deflation measure after the war, and as such a measure it served its purpose. While it was first used as an economic narcotic, it has become a powerful and dangerous stimulant at the present time, although its evil effects depend entirely on the volume it reaches as against the total earnings of the people. The average individual cannot forever keep on spending more than he earns. Many people are always obligated in advance to such an extent that the prompt payment of physicians' or dentists' bills is an impossibility.

Economists tell us that in March of this year, more than $8,400,000,000 was outstanding on installment purchases of goods. This figure tells us that each American family is obligated to the ex-

tent of an average of $350. Payments on homes or real estate are not included in the estimate. When it is remembered that the average yearly income of the average family is slightly less than $1,500, the seriousness of the situation is apparent. It means that the average family has already spent $350 of the income that will be earned during the coming year, provided the income is earned. Of course, these averages are mathematical and theoretical only. While many individuals do not earn $1,500, there are many who do not obligate themselves to the extent of $350. It is because of the fact that a large proportion of the people earn a satisfactory competence and obligate themselves only to insignificant amounts that the professional man is able to exist as well as he is existing at present.

To meet the difficulty of installment buying, groups of dentists and physicians have organized finance companies in various locations for the purpose of enabling the patients to employ needed professional services and pay for them out of income. Much is claimed for this method of collecting accounts by those interested in the finance companies. Personally, I much prefer the direct method of discounting the note of a responsible patient with the endorsement of the dentist at a bank in all cases where the credit rating of the endorser is satisfactory. This seems to me to be a desirable, convenient and economical method. If the credit rating of the endorser is not satisfactory to a bank, the use of a finance company, under the present regrettable prevailing conditions, is, in my opinion, justifiable, though there may be some question as to whether it is a sound economic procedure.

The members of the dental profession are also confronted with the problem of the rising cost of dental service. These rising costs are a direct result not only of the employment of improved apparatus, materials and methods and the general use of such additional diagnostic means as the roentgen rays and pathologic laboratory tests, but also of the increased cost of rent and other necessary overhead expenses. Undoubtedly, the average layman, not having a full understanding of those matters, often considers his dental bills to be excessive. Dental fees are not infrequently misunderstood and the dentist is made the subject of unjust criticism.

Another economic disadvantage under which the dentist labors is the fact that the great majority of people do not yet understand the importance of putting and keeping the mouth in a clean and healthy condition. At the present time, judging from the statements of observers, it would, I believe, be conservative to state that between 75 and 80 per cent of the people of this country never approach a dentist for other than the extraction of teeth and finally to have dentures made. This great majority is still ignorant of the true value of dental treatment. I am fully convinced that 90 per cent of our population still are unaware of the relationship between a clean mouth and a healthy body. The fact that dentistry is one of the most important links in the chain of disease prevention is unknown to even a larger percentage. Furthermore, dental hygiene instruction in the schools by qualified dental hygienists has not yet been adopted in many otherwise enlightened communities, and this important means of educating the public concerning the necessity for the proper care of the teeth is only beginning to be developed. Where the true value of dentistry is not understood or appreciated, dental fees are often considered exorbitant and burdensome.

If 100,000,000 individuals of the population of this country were to have their teeth cleaned in a dental office only twice a year, it would keep almost 120,000 dentists and hygienists busy doing this work alone, if we estimate that there are 1,680 operating chair-side hours to the year and set aside one hour for each prophylaxis. The amount of dental disease that would be disclosed if this theoretical condition should become an actuality staggers the imagination.

A recent report of the Rosenwald Foundation discloses the fact that but 3 per cent of the income in the average family is spent for medicine, hospitalization and the services of physicians and surgeons. If this is true, and if we consider the much smaller proportion of persons who at present make use of the services of the dentist, the average expenditure for dental services for each family could be estimated at less than 1 per cent of the total income. Statistics on this point vary greatly, but all reveal the tendency of the great majority of American families to consider expenditures for semi-necessities such as the radio and the automobile of more importance than expenditures for dental service. It has been contended by some that the income in the average family is too low to allow for expenditures for health service, and this is undoubtedly true in numerous instances. In the majority of cases, the willingness to make an expenditure for good dentistry is not so strong as the desire to purchase other services or commodities of lesser importance. Moreover, the people have yet to learn that payment for the services of a dentist often precludes the necessity for employing the physician. They do not realize the truth of the axiom that prevention is much better than cure. They have not been educated to the realization that every dollar spent in the office of a capable dentist may obviate the necessity of the eventual expenditure of a larger sum for extended medical care.

Another growing difficulty to the dentist and dentistry is the pernicious effect on the public of the blatant announcements of the advertising dentist. The advertiser cheapens and discredits dentistry by proclaiming it a thing of materials and bargain prices. Boasting and misleading statements are usually used with heedless abandon. The flashing electric signs beckon perhaps only the ignorant and unwary, but the constant daily repetition of misleading statements has its evil psychologic effect on the public. As a result, fair dental fees are often protested and criticized.

Still another handicap under which the dentist works is the custom of doing free or charity work for individuals who cannot afford to pay by reason of poverty. I do not wish to say anything to discourage a dentist from doing an occasional act of charity for persons whose financial misfortune is temporary. If such free work can be done not too frequently and without affecting the cost of service to the patients who pay, it is to be commended. The average dentist would not be satisfied to be denied the privilege of using his talents in particularly worthy cases. The ordinary habitual indigent should be the charge of the whole community, and his dental and medical treatment should therefore be paid for by the community. The cost of the service given should not be borne by the dentist or passed on by him to his pay patients. The economic aspect of this whole matter is too evident to require further elucidation here.

These, then, are the economic handicaps under which every dentist is working. Despite the conditions mentioned, the

great majority of dentists are prosperous. A report on the income of a considerable number of dentists made in April of this year shows that, aside from the satisfaction that each dentist obtains because of the health service that he renders to the public, dentistry is not at all unattractive to a considerable proportion of the profession from the point of view of income. In fact, the survey revealed the fact that the gross income of the average dentist is much higher than has been previously reported.

CHARACTERISTICS OF THE SUCCESSFUL DENTIST

Many dentists are highly successful economically because they are able to give a high type of service to their patients. What, then, are the characteristics of a truly successful dentist? First, he invariably possesses the fundamental requisite of ability. He has a thorough knowledge of his profession. He is an enthusiastic student of dental literature, owns a library of scientific books and is active in dental society meetings. He is engaged in a constant search for professional information that may be of value. He encourages research and is eager to learn and to improve his professional and scientific equipment. He is careful to keep himself up-to-the-minute in the methods of practice of his profession. He employs modern methods of diagnosis, works in close cooperation with the medical profession and all recognized public health agencies and utilizes to the fullest extent the specialized aid of the dental hygienist, the dental assistant and the dental technician. In short, he is not only *able,* but *modern* as well.

Besides ability, the successful dentist usually possesses many, if not most, of the natural personal qualifications that I have already mentioned. He is physically fit and keeps himself so. He is thorough, accurate, cautious and tactful. He is willing to take infinite pains in his professional work and has no tendency to take the course of least resistance. He possesses initiative, imagination and ambition and is filled with a sincere desire to serve mankind. He is scrupulously honest, stooping to no subterfuge or deceit. He is careful in all matters concerning his patients, and therefore all of his records are kept accurately and in sufficient detail. He possesses common sense, and hence knows enough to collect his accounts and differentiate between the "dead-beat" and the patient who pays his bills. This same faculty of common sense aids him in selecting a location where his services are appreciated. He spends less than he earns and invests the excess wisely, thus providing a fund in anticipation of old age. He has the manners and instincts of a gentleman and enjoys associating with his fellow citizens. He is liberal and broad-minded and is tolerant of the opinions and beliefs of others. He is well informed on matters of general interest in the community and perhaps even takes an active part in public affairs. He is usually fond of literature, art or music, sometimes of all three. In short, he possesses the poise and attributes of a man of culture.

To the degree that a dentist fails to measure up to these high qualifications, he will fail to attain the fullest measure of success in his professional life. I am cognizant of the fact that perhaps all of the qualities mentioned have never been combined in any one individual, but I am equally certain that there are many who would rank exceedingly high, if they were graded with this standard as a basis.

CHARACTERISTICS OF THE AVERAGE DENTIST

Many dentists are only moderately successful. What are their usual characteristics? The average dentist, in my opinion, usually is possessed of the ability to practice his profession, he takes an interest in dental society meetings, he maintains a library of scientific books, he is honest, he keeps records fairly accurately and collects a reasonable proportion of his accounts and he is often active in civic work or club work. His usual negative qualities might be briefly enumerated as follows: He lacks that enthusiasm for the additional knowledge that is necessary for the highest degree of ability and is therefore not willing to pay the necessary price of hours of toilsome study. He often has no hobbies outside his profession and does not know how to play, and when this is true, he does not keep himself in the best physical condition. To the degree that he lacks common sense and caution, he may make poor investments with his earnings, and often his outside financial losses keep him worried and poor to the end of his days. While he usually lives within his means, he sometimes is inclined to spend too much for unnecessary luxuries, a fault that is common to many Americans.

CHARACTERISTICS OF THE FAILURE IN DENTISTRY

The dentist who may be classified as an out-and-out failure lacks many, if not most, of the fundamental characteristics that have been mentioned. While he once probably had the ability, if not the natural aptitude, to practice his profession, he is devoid of the energy and ambition which he must have in order to keep abreast of the times. He spends hardly any time in study; in fact, his library of scientific books is nonexistent. He usually lacks common sense, and this deficiency may manifest itself in manifold ways. For example, he is usually careless about keeping records, whether they be case records or financial matters. His office or personal appearance or both do not inspire confidence in his patients. His low ideals of service make him unwilling to take the infinite pains necessary in order to give his patients the honest service to which they are entitled. His diagnostic methods are usually correspondingly superficial and unreliable. In certain cases, dissipation in some form or the improper use of his leisure time or disturbing home influences is the direct cause of failure. Obviously, a dentist who is not physically fit and mentally alert at all times soon loses the confidence of his patients.

It is unnecessary to dwell longer on these fundamentals. While it is true that there are in practice today a large number of highly successful dentists, it is likewise a regrettable fact that there are a considerable number who are failures from every point of view. And then, between these two extremes, there is every gradation of failure and success.

REMEDIES COMMONLY SUGGESTED TO IMPROVE THE DENTISTS' ECONOMIC STATUS

Let us review briefly the remedies that are commonly suggested to aid the dentist who, because of certain of the deficiencies I have mentioned, is not so successful professionally and financially as he could and should be. One remedy that is being experimented with by a small but increasing number of dentists consists of enrolling in one of the short courses in so-called dental economics given by individuals, often not members of the dental profession. These courses usually cost a substantial tuition fee and hold forth the

hope of correspondingly future financial success for the ambitious student. I have no first hand knowledge of what is taught in these courses, since I have never availed myself of the invitations that I have received to enroll as a student. I am therefore not in a position to criticize them specifically or in a detailed way. I am told that these courses deal largely with such superficial matters as sales psychology, arrangement and quality of office equipment, the use of record systems and kindred topics instead of with such fundamental questions as the efficiency of professional service to the patient. I do not believe these courses will do much lasting good. It seems to me that a dentist who feels himself in need of such a course could get the same suggestions, though less highly colored, by interviewing a brother dentist whose success is obvious and who would be glad to lend a helping hand. And as for record and bookkeeping systems, any reputable dental dealer has on hand and offers for sale several inexpensive and simple yet highly efficient systems and can explain the use of the one chosen in half an hour.

I do not believe that these courses will do any lasting good; in fact, let me add that, on the negative side, they may do much harm. It is interesting to note that a considerable amount of competition has developed in this field, and judging by the bitterness with which the proprietors of these short courses criticize and denounce one another, it must be an exceedingly profitable business.

No other profession is subject to similar attention by the owners of similar short course schools. Nothing like these courses would be encouraged in other learned professions such as medicine or law. A physician or a lawyer, if offered a course in sales psychology as applied to his profession by an outsider, would promptly resent it as an affront to the dignity of his profession. Furthermore, I believe that these courses, if given to increasing numbers of dentists, will eventually tend to destroy the faith that the public reposes in the profession. Lastly, I feel that dental education should be a function of a university or a duly recognized dental society.

A second remedy suggested is that the dental schools forthwith enlarge and extend their courses in dental economics. It is felt by many that if a course in economics were made an important part of the undergraduate dental curriculum, many of the failures in the profession might be prevented. I will admit at once that a good course in dental economics combined with professional ethics should be taught in every school, and that, if there are any schools that are neglecting to include such a course, they are, in my opinion, open to serious criticism. The question as to whether or not the courses that are given should be extended materially is a debatable one. To overemphasize the economic side of dentistry would be a serious mistake, because it might give the student and young dental graduate a distorted notion of his true function as a dentist.

We already have enough of the commercial spirit in young people of college age. The difficult thing is to convince many of our dental students that the financial return is merely incidental to a life of service. The tendency among many is to consider the service given as a mere incident in the earning of fees. It is in the wise direction and guidance of this tendency that most of the value of a good course in economics lies.

Still another complaint that is freely made, particularly by the dentist who does not find dentistry a profitable voca-

tion, is the fact that there are too many dentists. The suggestion is sometimes, though, I believe, infrequently, made by these individuals that dental schools could reduce the number of dental graduates by raising the attendance requirements from five to six years, thus providing a better opportunity for those already in the field. An extended discussion of this phase of the subject is impossible here. I merely want to point out briefly several facts which have a bearing on this question. In the United States in 1928 (the latest statistics available at the time this paper is being written), 2,148 new graduates were licensed to practice dentistry in the various states. Five years before that, in 1923, 2,708 were licensed. Ten years before, in 1918, 2,508 were licensed. The conclusion, then, is that dental schools are not violating the law of supply and demand by flooding the country with too many dentists. They are, on the contrary, graduating fewer dentists now than they did five or ten years ago. Furthermore, any qualified observer or any leader in the dental or the medical profession will agree that there is a greater demand today for dentists capable of giving efficient service than there was ten or twenty years ago.

What effect would the arbitrary raising of requirements to a course of six years have on the attendance in dental schools, if that were done contrary to logic and common sense? I confess that I do not know. Medical schools despite the required seven-year course are filled to capacity with students. In 1928, while 7,014 medical freshmen were admitted in the Class A medical schools, 5,523 students who had completed their premedical college courses could not secure admission because of lack of room.

These, then, are some of the suggestions that are commonly being made with the purpose of improving the economic status of the dentist. Whether or not they are ill-considered should be evident to anyone who investigates the matter.

HOW THE ECONOMIC STATUS OF DENTISTRY CAN BE IMPROVED

There most certainly are a number of practical things that may be done which will have the effect of improving the general economic condition of the dentist. It will be my object to present some of these for your consideration. The first and basic suggestion that I will make relates to the proper education of the dental student. No one will deny that the general education and culture of the dentist should be made equal to that of the lawyer and of the physician. A step in this direction can be accomplished by requiring the same general education for admission to the dental school as that required for the law school or the medical school. This now consists of two years of prescribed liberal arts college work in addition to a high school education. To the degree that a dental school fails to make this requirement and to enforce it strictly, it is falling below the standards set by medicine or by law. There can be no social or intellectual equality between medicine and dentistry until the entrance requirements for the two professions are put on a basis of equality.

All students before being admitted to the dental school should be examined critically for unfavorable characteristics. In the past, students have sometimes been accepted whose physical appearance clearly indicated that they could obviously never become successful in the profession. Then, too, students whose high school or college records indicated that they had consistently been graded in the lowest third or lowest fourth of their classes have been accepted by some

schools. The exacting requirements of dentistry should have precluded their admission to the dental school.

After the committee on admissions or the admitting officer has made reasonably sure that the student has the superior intelligence that is demanded and that he possesses the personal qualifications for the successful study of dentistry, the student may be admitted. During the first semester, he should be tested thoroughly to discover the extent of his inherent mechanical and digital skill. If he shows that he is deficient to any considerable degree, his further continuance in the school should be discouraged or he should be put on strict probation. If he is deficient to a marked degree, he should be dropped from the school, notwithstanding the good record that he might present in the medical science courses.

If all dental schools eliminated the unfit from their student bodies at the end of the first semester of the first year of the course, there would be fewer failures in the practice of dentistry. An alert faculty should be able to discern the deficiencies of any young man during the period of half a year. Rejection of students because of lack of ability or objectionable personal characteristics should be very rare in the later years of the dental course, if the observation given the student during the beginning months is thoroughly accomplished. Rejection for the slightest evidence of dishonesty or other moral deficiency must be made without mercy at any time during the course. It requires a high sense of ethical standards to practice dentistry successfully, and young men who lack this quality can never succeed in the profession.

All of the dental schools rated as Class A or B by the Dental Educational Council of America presumably offer curriculums which will give any young man with the proper inherent qualifications the ability to practice dentistry. In addition, the student should receive a judicious, sensible and well-grounded course in dental economics and ethics, preferably in his senior year. An eager regard for the highest plane of professional ethics n ust be inculcated along with lessons in business methods. Emphasis must be given to the fact that any continued infraction of the rules of ethics is without profit in the end, and that the professional ostracism suffered by the unethical dentist, together with his low social standing in the community, as well as the reproaches of his guilty conscience, is punishment too heavy to be paid for in terms of ill-gotten gains.

I should like to tell you what, in my opinion, a course in dental economics and ethics should embrace, but I am prevented from doing so by the limits of this paper. Aside from such subjects as choosing a location, building and managing a practice, keeping records and making purchases and disbursements and financial investments, a considerable part of the course should be devoted to a discussion of the required personal habits of the professional man, the necessity for culture and the relationship of the dentist to the members of his own profession, to the medical profession and to the community in which he resides.

The proper selection, elimination and education of the dental student, the dentist of the future, is therefore fundamental, if the economic status of the profession is to be improved. But what suggestions can be made that would be pertinent for those who are already members of the profession? As I have indicated, nothing can be done for the out-and-out failure. He lacks the inherent qualities to secure the confidence of the

public; he is too indifferent or self-satisfied to keep his knowledge of the profession up to date, and therefore is incapable of giving efficient service. The quicker such a failure is discouraged from continuing in the practice of dentistry, the better for all concerned.

The great majority of dentists, those possessed of the necessary natural qualifications and the knowledge to practice their profession efficiently, can be aided greatly by membership in the American Dental Association. I look on this great body as an organization whose chief function is the education of its members. An active and enthusiastic member is *per se* keeping abreast of the times and developing his natural talents. A larger, more influential and a more active American Dental Association is therefore fundamental to a more efficient and consequently a more prosperous profession. Some years ago, when I had the honor to serve as President, I made the statement that wherever organized dentistry is strong, there dental service is efficient, and, as a result, the public is benefited and the dentist prospers. Mere association on a fraternal and friendly basis with the successful members of the organization alone will be of more benefit to the dentist who may be making a few mistakes in judgment or who may be a bit discouraged than any of the commercial high-powered courses in dental economics that are now being offered. Extend the membership of the American Dental Association so that its educational influence may reach every promising dentist who is possessed of the proper moral and ethical standards. Surely, this is a worthy objective for us to strive for and achieve.

The work already accomplished by the Chicago Dental Society through its very active and efficient Committee on Dental Economics is an excellent example of the help that organized dentistry can give to every ethical dentist. The scope of the study that has been made by the committee during the past year is so comprehensive that it presents sufficient material for a dozen or more papers. The classes in dental economics organized by the committee during the past year were largely attended by members of the society. The work of the committee is certain to result in increased efficiency of dental service to the people of Chicago, and hence in increased prosperity for the members of the society. All component societies of this Association, as well as all study groups, would do well to become familiar with the work that has been done in Chicago and make it a pattern for similar efforts. The effort put forth by the Chicago Dental Society can be duplicated by any other group of dentists and is a fine exemplification of how dentists may improve their knowledge of the business side of their profession without the aid of proprietary courses conducted by outsiders for the tuition fees and other benefits involved.

Dental groups who desire to begin organized consideration of dental economics are likewise referred to the survey that has been begun in our own association and which will be reported by Herbert E. Phillips of Chicago at this meeting, and also to the work of the Committee on the Costs of Medical Care having its headquarters at Washington, D. C., and with which the American Dental Association is cooperating. The wide scope of the work of this committee will be realized when it is noted that the amount set aside in its 1930 budget for purposes of investigation is $212,000. The Committee is "organized to study the economic aspects of the prevention and care of sickness, including the adequacy, avail-

ability and compensation of the persons and agencies concerned." It has recently published the results of a survey of the medical facilities of Shelby County, Indiana, which contains highly interesting information concerning the economic condition of dentists practicing in a typical agricultural community centered around a county seat of about 10,000 inhabitants. Copies of this instructive report are available to those interested.

Another way of improving the economic status of dentistry is by aiding and securing help from philanthropic sources for the dental schools that are eager to give graduate instruction. Until the graduate departments of the various dental schools are developed to full efficiency, the dental profession must expect to lag behind other learned professions. Postgraduate courses in dental economics would undoubtedly be offered by these graduate departments to the great benefit of the profession. Cordial service and regard for the public welfare would be stressed rather than selling psychology, office record systems, clock dial stamps and plateglass doors for sterilizing rooms.

If such graduate departments had the financial resources, they might make progress in the problem of originating methods which would make it possible to give better dental service to the public at less ultimate cost. As an example of such research, the recent work of the United States Bureau of Standards with amalgam will be remembered. As a result, amalgam, one of the least costly of the filling materials, may be used with greater certainty of success, greater satisfaction, and, as a consequence, a saving of money to the public. Such savings can and will eventually be made in many of the operative and prosthetic methods as well as in materials. While the initial costs may not be affected, the final costs to the patient over a period of years should be reduced materially by reason of improved health and increased personal efficiency. Think what it would mean to the people as well as to the dental profession if the graduate department of some dental school were to discover a specific for the cure of pyorrhea, so-called. The savings made possible through the greater efficiency and knowledge of dentists are obvious, and the profession as well as the public would profit thereby.

Before the dental profession can be of the fullest service to the public, unquestionably the public must be educated fully to the value of dentistry. There is no more effective way of accomplishing this work of education of the public than by supporting energetically the movement to place properly trained and well supervised dental hygienists in the public as well as the private and parochial schools. No other means of educating the masses to the health-saving, health-preserving value of dentistry can approximate the value or effectiveness of the work of the dental hygienist. The amount of dental service that is being given will eventually be increased several hundred per cent through the medium of the dental hygienist, and the public as well as the dental profession will be the gainer.

Another effective and necessary method of improving the economic welfare of the profession lies in strengthening the laws regulating the practice of dentistry, making it possible actually to punish the licensed dentist or the employer of a licensed dentist who causes false or misleading statements to be included in advertisements printed in the newspapers and in other publications or on handbills. The printed advertisements of the unethical dentists who exist in relatively large numbers in some of our centers of population today are undoubtedly doing

a great deal of damage to the dental profession by destroying the confidence of a considerable portion of the public. Of course, the understanding and intelligent part of the public sees through the deceit in these advertisements and the trickery practiced by the unethical dentist. A considerable portion is manifestly not intelligent enough to discover this chicanery and deception and to resist the eyewash and hokum to which it is subjected in the average unethical dental office. The individuals who constitute the unenlightened are often those who are most in need of honest dentistry. It is unfortunate that their lack of understanding is further distorted so that many of them are convinced that dental service is characterized mainly by reduced prices on various materials and free examinations.

The medical profession has made great strides in improving the situation with respect to medical quacks so that none of the leading self-respecting newspapers will print advertisements carrying misleading medical information. The dental profession should make every effort to secure a similar cooperation. In the interest of public health, dental licensing boards should be given wider powers, if possible, in refusing licenses to all of those who do not subscribe to the highest ethical standards of the profession.

Economic problems relative to the increase of industrial dental clinics, dental clinics supported by public funds or other clinic organizations through which service would be rendered to all classes by dentists employed for a fixed fee or on a salary are not yet important enough to affect the present generation of dentists. Since the state and industry are interested in healthy citizens and efficient workers, an increasing effort will undoubtedly be made through compulsory health insurance, part pay clinics, industrial clinics or departments of public health to provide dentistry for all persons. Thus, the dental profession in America may be confronted with the same economic problems as those that are being encountered at present by our colleagues in certain European countries. These problems must be met in the future and should be solved under the auspices of the dental profession, not under the direction of lay groups who would be interested mainly in purchasing dental services as cheaply as possible. The aggressive leadership of the dental profession is necessary to prevent the development of these serious and revolutionary economic conditions. If they are not met wisely, they may even lead to professional deterioration. The situation should be thought out before it develops in this country so that the wisest course of action in the public interest may be adopted. A further discussion of this question is manifestly impossible here.

I stated near the beginning of this discussion that it would be impossible for me to make any detailed suggestions concerning office practice, since it is my purpose to discuss only fundamentals. The most important single suggestion which I could make to any individual dentist and which could serve as a basis for his economic success would be to conduct all of his financial affairs in accordance with a carefully prepared budget of income and disbursements. A budget is fundamental if a dentist would plan for success and financial prosperity. In fact, each dentist should conduct his affairs according to the plans laid down in advance in two separate budgets, one for his office, the other for his home and personal expenses. Of these two the latter is often the more important.

The budget needed to guide the conduct of the office should take into consideration all necessary expenses as well as

an estimate of income. A certain amount should be set aside as the monthly profit or salary which the dentist should pay himself. If, at the end of the year, the business shows an additional profit, the dentist may declare an extra dividend. If, on the other hand, the business shows a loss, the dentist will have the data to plan a curtailment of certain expenses or an increase in certain fees or other necessary adjustment. The cost of conducting a dental practice varies from 25 to 50 per cent of the gross income, depending on the character of the practice, the location of the office and the amount of assistance that the dentist employs, so that it is impossible to present a model budget for your consideration. It is obvious that the business activities of every dentist, just as is true of every commercial enterprise, should be planned well in advance each year. Success in dentistry like success in every other undertaking must be carefully thought out. The ideal must be present in the mind before there can be a striving for it.

The personal budget of the dentist, the plan for the management of his net income, is, as I have suggested, of great importance. Of course some individuals are naturally prudent with household and personal expenses and therefore need no stimulus to cause them to save a part of their earnings. Moreover, they are cautious enough to invest their savings conservatively. The great majority of professional men would undoubtedly benefit by planning and then recording a budget of income and disbursements at the beginning of each year. Amounts may be determined to be set aside for rent, interest, taxes, wearing apparel, food, household expenses, recreation, charity and contributions, miscellaneous insurance, life insurance and savings. The most important of these items are the last two; namely, life insurance and savings, and nothing but the most unexpected emergency should interfere with their accomplishment.

Life insurance is not only a duty to one's family but a profitable investment as well. This is particularly true for the professional man who cannot afford to divert his attention unduly from his professional duties in order to watch his investments. Furthermore, life insurance is the only financial arrangement that is guaranteed to mature a certain amount of money at an uncertain time or a certain amount of money at a certain time for use during old age. One hundred and three billion dollars of life insurance was in force in the United States at the close of the year 1929, a fact which alone proclaims its desirability for protection and investment. A paid-up life insurance policy of sufficient size is a certain preventive for financial worries in old age. The nature of the contract may be suited to fit each individual need, although, for a married man past middle life, an ordinary life policy with its relatively lower premium rate will yield the best results.

Aside from his life insurance savings, the dentist should strive by earnest effort for the ideal recorded in his budget to build up first a savings account and then an investment account. Many dentists have ruined their lives through speculation and unwise investment. These unfortunate losses could have been prevented largely, perhaps entirely, if dentists realized generally that the investing of funds requires specialized knowledge and rare discrimination. Dentists should, when they have funds to invest, seek the advice of a competent investment banker. Investing is just as much a special function as dentistry, and it is unlikely that the average professional man will excel both in his vocation and in outside ven-

tures. The dentist who depends on the statements of salesmen or other persons who may be interested in the sale of bonds, stocks or real estate without thoroughly checking the information through his banker is courting financial disaster. There is nothing more detrimental to efficient professional service than financial worry, and the dentist who invests his savings conservatively is invariably able to look on the period of his retirement after a life of service in behalf of the public health with peace and satisfaction.

What a wonderful profession dentistry would be if all dentists could be convinced that the few simple steps to certain financial success are, (1) the carrying out of a carefully planned budget; (2) the maintenance of a life insurance account and a savings and investment account, and (3) the use of caution and the specialized knowledge of the investment banker. Under such circumstances, we might all be prosperous, and this prosperity would be reflected in the improved service that we would be enabled to give to the public.

More discriminating selection and better education of the dental student, education of the dentist, education of the public, strengthening of the laws preventing quackery, as well as thrift and caution on the part of each individual dentist, are all fundamental to the achievement of more efficient dental service, and hence an improved economic success for the dentist.

ECONOMIC RELATIONSHIP OF THE PROFESSION TO THE DENTAL DEALERS AND MANUFACTURERS

While the dental profession as represented in the American Dental Association and its component groups is taking the necessary steps to improve the opportunities in dentistry, it should likewise logically make some very necessary internal improvements. I shall mention three of these briefly. The dental profession is unique among the learned professions in the economic relationship that exists between the profession and the dental dealers and manufacturers. Postgraduate instruction to dentists is still very largely conducted by dental manufacturers and dealers in dental supplies. This condition is obviously brought about by the fact that the great majority of the dental schools, in which graduate instruction should be given, lack the funds with which to support these courses. Every thoughtful member of the profession agrees that this is unmistakably wrong, and for this reason I shall only call it to your attention. Argument would be superfluous.

Furthermore, the dental profession and the dental manufacturers have, as far back as I can remember, been associated in another anomalous relationship. I refer to the manufacturers' technical exhibit which, for the past decade, has been so large and so efficiently organized that it transcended practically any other single feature of the program. While I have no objection to a technical exhibit as such and freely admit its educational value, I nevertheless believe that it should be conducted by the manufacturers themselves and have no connection whatever with our program. It would be my hope that every dentist in attendance would avail himself of the opportunity to visit such an independent exhibit in order to inspect the marvelous improvements in dental materials, instruments and apparatus so skilfully displayed for his information. It is to be hoped that the not distant future will witness the complete separation of the commercial and educational part of our program, as well as the removal of any relationship of

dependency between the manufacturers and dealers and the dental profession, to the end that our relation to manufacturers and dealers may be placed on a more dignified and satisfactory basis.

Another commercial tendency is trade journalism or ownership of dental magazines by manufacturers. I hesitate to mention this out of a sense of gratitude to a number of these periodicals. The profession certainly owes a debt of gratitude to the editors of these dental journals as well as to their employers. Were it not for them, there would have been no dental periodical literature in the past. Since dentistry has become an important health service profession and assumed the status of a learned calling, it should, together with its associated or integral professional groups, assume the direction of its periodical literature. Thirty-two of our strongest societies and boards are already on record as in favor of controlling the publication of our own literature. I pointed out at Detroit three years ago that if THE JOURNAL were published twice a month instead of monthly, practically all of the worth while papers read before this organization and other groups might be published in it. If this were done, the necessity for these trade publications would disappear. The dental profession would then cease to depend on the manufacturers for the publication of a considerable part of its scientific literature. Moreover, I am inclined to believe that the manufacturers would welcome this step since the drain on their advertising budgets because of the publication of these journals must be heavy indeed. In the last analysis, this cost must be passed on by them to the members of the dental profession, in one form or another.

Before I finish my remarks concerning the objectionable present relationship or dependency between the dental profession and the commercial interests, I wish to make it clear that I am not criticizing the latter. On the other hand, I am grateful for what they have done. I desire to add that I know from first hand experience as well as attendance at their meetings and participation in them as a speaker that no finer or fairer group of business men exists anywhere. Whatever they have done and are doing has been in a spirit of helpful cooperation. However, their present relationship to dentistry should, notwithstanding this fact, be changed.

CONCLUSION

In closing this analysis of the economic aspects of dentistry, I wish to remind every member of our profession again that dental service belongs to the public, not to the dentists. I hope the time will never come when pseudopsychologists and economists will substitute a strictly business and sales efficiency relationship between the dentist and his patient for the relationship of confiding friendship and mutual trust that should exist. When the dentist regards his patient primarily as a means of earning a livelihood rather than an opportunity to extend the important service that he has been chosen to perform for mankind, the heart will go out of dentistry. Too much reliance on strictly economic formulas will inevitably lead the way to state-controlled dental clinics. State dentistry would, theoretically at least, represent the height of economic efficiency, just as it would, if persisted in, mean the death of professional development.

As dentists, we take great pride in our profession and experience real satisfaction in knowing that our vocation is essentially preventive in character. We know that our ministrations are absolutely and

basically necessary in order that the public may receive complete health service. The public is dependent on us and has a right to expect us to be capable, efficient and skilled in the art and science of our profession. We cannot possibly meet this high qualification unless we are financially prosperous to the degree in which we serve. Any steps that we may see fit to take to improve our economic situation, provided they are in harmony with the traditions of a profession of service, may be justified only on the grounds of efficient service. And, in our prosperity, let us measure our success not alone in terms of dollars and cents, but also in terms of patients served, health service given and lives saved.

PYROCHEMICAL REACTIONS IN THE FIRING OF PORCELAIN

By J. RAYMOND GILL, D.D.S., San Francisco, Calif.

PORCELAIN, which is used so extensively and the use of which is a fine art in dental practice, requires not only a thorough understanding of the technic employed, but also a knowledge of the ingredients of which it is composed. Porcelain is of a complex nature, because of the chemical reactions of one or more of the ingredients on the others. The agent used to produce these chemical reactions is heat, time also being an important factor.

The higher or nonfusible materials are used as the body, and the fusible materials act as a bond by which the higher nonfusible materials are held together. In dental porcelain, the fusible materials serve not only as the binder, but also to obtain translucency after glazing.

The ingredients are prepared in such a way and combined in such proportions as to obtain the most desirable results considering the purpose for which they are to be used.

The selection of the felspar, clay and flint as to purity, i. e., freedom from metallic oxids and organic materials, is of the utmost importance. The proper sizing of the particles so as to obtain a nonporous, translucent porcelain and one of sufficient strength after glazing is also important.

Aside from the manufacture of dental porcelain, there are two other factors that must be observed: (1) condensation, and (2) pyrochemical reactions in the firing of porcelain. Neither of these can be neglected, as they are of equal importance.

In discussing the changes that take place during firing, there are two distinct stages: (1) physical stage: (a) dehydration and (b) oxidation, and (2) chemical stage: (a) oxidation, (b) soaking, (c) vitrification and (d) glazing.

PHYSICAL STAGE

During the low temperature rise, the hygroscopic water or "the water that has been added to the powder to make it plastic" is driven off. The largest amount of water is driven off between 200 and 600 F. As the temperature is increased up to 900 F., the balance of the hygro-

scopic water is eliminated. Between the temperatures of 900 and 1,200 F., the chemically combined water is removed. From 900 to 1,400 F., the organic material is removed as carbon dioxid. The temperatures between 900 and 1,600 F. may be termed the smoking period, because, owing to the burning off of the organic material and decomposition, the porcelain becomes dark. As the heat is increased, it again becomes light.

Between 200 and 1,400 F., the increase in temperature should be slow and constant. This will allow the water and the carbon dioxid to escape without distortion of the internal structure of the porcelain. During this stage of firing, the porcelain loses its plasticity, increases slightly in volume, becomes more porous and loses weight. (Figs. 1-5.)

The specimens that were made for these tests were placed in the furnace below 200 F. The temperature was raised to 400 F., and all were removed from the furnace and the weights taken. One specimen was then replaced in the furnace

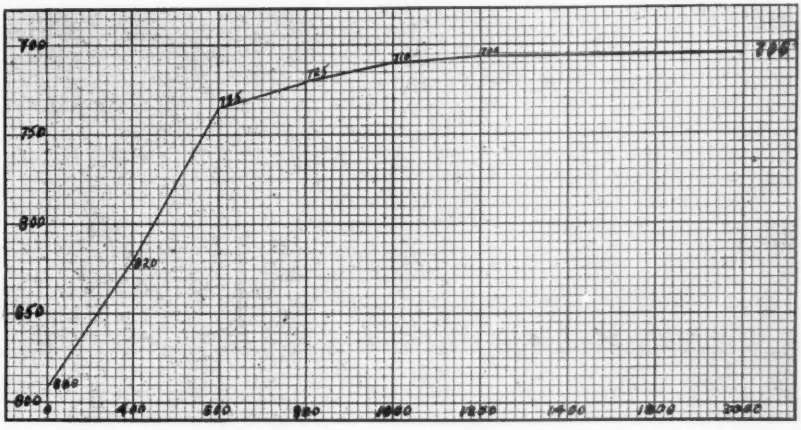

Fig. 1.—Method of condensation, spatulating; percentage loss of weight during firing, 20.15.

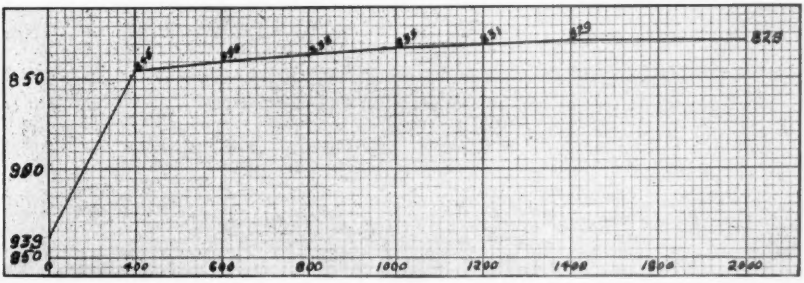

Fig. 2.—Method of condensation, vibrating in paper matrix; percentage loss of weight during firing, 11.7.

below 200 F., and the temperature was raised to 600 F. This specimen was then removed and the weight taken. This was repeated with the same specimen every 200 degrees up to 2,000 F. Above 1,400 F., the specimen lost no more weight, which shows that all the moisture had been removed by heat at that temperature.

The muffle door should be left open or proper vents provided to allow the moisture and the carbon dioxid to escape during this stage of firing.

Decomposition of the fluxes (sodium carbonate, calcium carbonate and potassium carbonate) takes place between the temperatures of 600 and 1,700 F., giving off carbon dioxid, leaving sodium oxid,

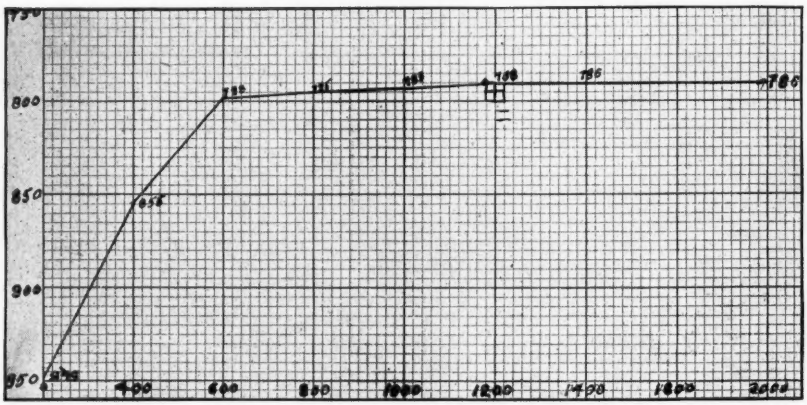

Fig. 3.—Method of condensation, whipping; percentage loss of weight during firing, 17.2.

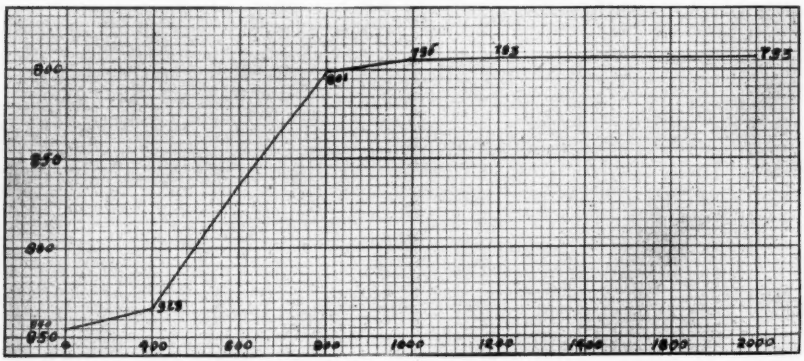

Fig. 4.—Method of condensation advocated by Dr. McBean; percentage loss of weight during firing, 15.65.

calcium oxid and potassium oxid. The rise in temperature should not be too rapid or the carbon dioxid may not escape, which leaves gases in the internal structure of the porcelain.

There is a dissociation of the other ingredients, owing to the elimination of the chemically combined water and carbon dioxid. As the temperature increases, the hydrosilicates and the alumina silicates begin to decompose.

Within the range of 1,400 to 1,900 F., the flumes go into solution and begin a chemical reaction with the felspar, forming new compounds, which lower its melting point. The physical changes that occur between 1,400 and 1,900 F. are: (1) slight contraction due to the molten materials beginning to fill in the interstices, causing the nonfusible particles to be drawn more closely together (Figs. 6-10); (2) slight increase in strength on cooling; (3) decrease in porosity.

It is difficult to determine at what temperature the physical stage ends and the chemical stage begins, because, in both stages, chemical and physical-chemical changes take place to some extent.

CHEMICAL STAGE

From 1,800 or 1,900 F. may be termed the initial chemical stage. The fluxes that are in solution react on some of the felspar and silica, lowering the fusing point of each.

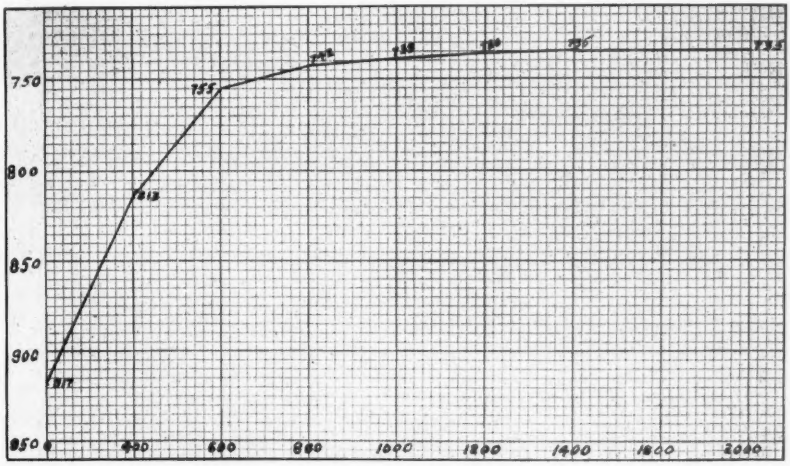

Fig. 5.—Method of condensation advocated by Dr. Filcher; percentage loss of weight during firing, 19.83.

The solution formed by the chemical combination fills the interstices, formed by the elimination of the chemically combined water and carbon dioxid. This may be termed the early part of the vitrification stage.

The first part of the vitrification stage is termed the soaking period. The purpose of prolonged heating at a constant temperature is to enable the various chemical changes which have begun at a lower tem-

perature to continue to the desired extent, so as to fill the interstices and obtain a proper bond between the particles of ceramic materials.

If the temperature is increased too rapidly, the peripheral pores will be sealed, which prevents the escape of air or gases that are entrapped between the particles of the material.

Prolonged heat or "soaking" increases the amount of fusible material and, consequently, the chemical reaction between the fluxes and refractories is increased, this producing a larger amount of vitrified or glassy material and a more nearly impermeable and translucent porcelain. As the temperature increases, the porcelain becomes completely vitrified, a process which is complete at from 50 to 100 F.

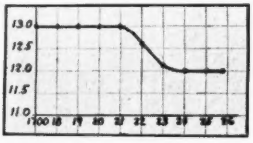

Fig. 6.—Linear contraction of dental porcelain during firing; method, vibrating in paper matrix; percentage of contraction, 7.68.

below the glazing point, which varies with the porcelain used.

When porcelain is completely vitrified, the porosity is decreased to its minimum. The shrinkage of the material is complete, maximum density is obtained and the strength is increased on cooling.

Vitrification commences when the lowest fusing fluxes attack the felspar, forming a glassy substance to fill the interstices between the particles of the refractories. Its completion is not reached at any definite temperature, but is dependent on the nature of the material, time and heat.

The rate of vitrification is slow at low temperatures, but is increased with the higher temperatures.

The chemical changes, which occur during the vitrification stage, cause various physical changes. The volume is slightly increased at the later part of this stage, because the particles are at their maximum equilibrium, but, on slow cooling, complete shrinkage is obtained. The porosity is decreased to its minimum, owing to the proper flowing of the fusible material into the pores.

The strength is decreased while at a high temperature, but increased on cooling, because the undissolved particles are firmly cemented together by the fusible

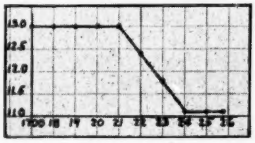

Fig. 7.—Linear contraction of dental porcelain during firing; method, spatulating; percentage of contraction, 13.84.

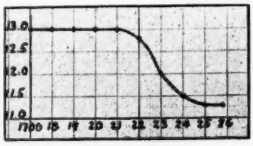

Fig. 8.—Linear contraction of dental porcelain during firing; method, whipping; percentage of contraction, 12.3.

material. Translucency is increased by the formation of glassy material, the product of the fusible fluxes and felspars.

When the vitrification stage is complete, the chemical reactions are arrested. The increase of time or temperature above the vitrification point without due care will cause the mass to deform.

The glazing or finishing stage is of short duration, sufficient only to obtain a glassy surface and increase in trans-

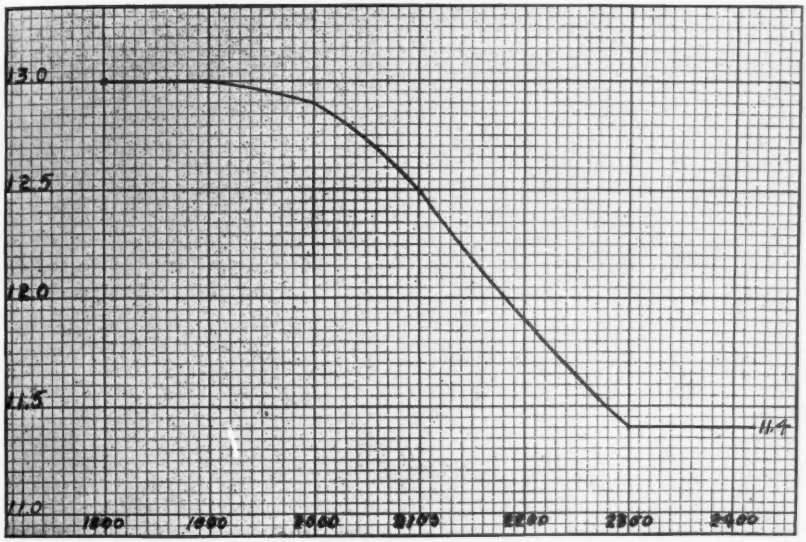

Fig. 9.—Linear contraction of dental porcelain during firing; method advocated by Dr. McBean; S. S. White H. F. porcelain; percentage of contraction, 12.3.

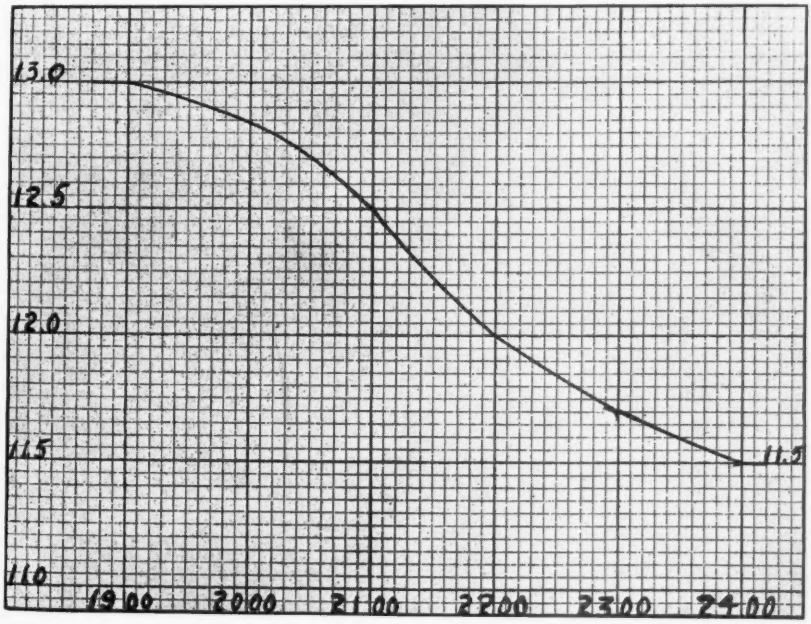

Fig. 10.—Linear contraction of dental porcelain during firing; method advocated by Dr. Fletcher; S. S. White H. F. porcelain; percentage of contraction, 11.53.

Fig. 11.—Microphotograph of S. S. White H. F. porcelain condensed by method advocated by Dr. McBean; fired as described in Figure 16; first firing to 2,150 F.; timing of the furnace was started at 1,900 F.; ten minutes from 1,900 F. to 2,150 F.; second firing, twenty minutes from 1,900 to 2,300 F.; glazed at 2,250 F.; twenty minutes from 1,900 to 2,250 F. Light areas are air spaces and darker areas are oxids resulting from fluxes.

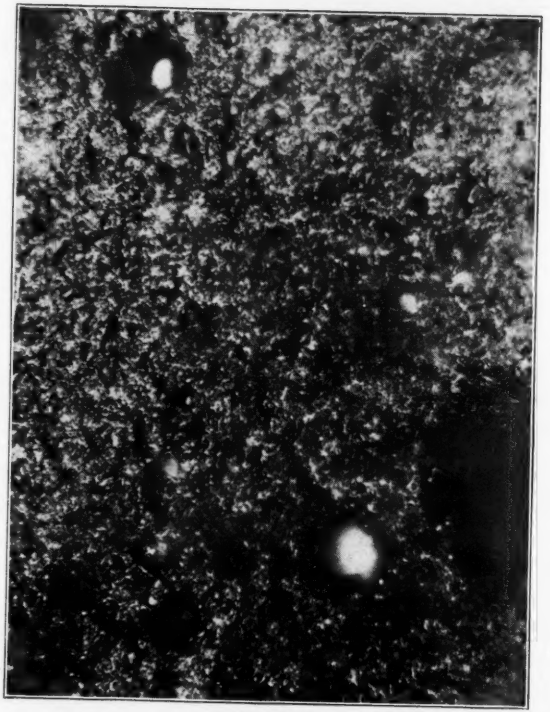

Fig. 12.—Microphotograph of S. S. White H. F. porcelain, condensed by method advocated by Dr. Fletcher. Method of firing was as described in Figures 11 and 16. The lighter areas are air spaces.

F.; glazed at 2,250 F.; twenty minutes from 1,900 to 2,250 F. Light areas are air spaces and darker areas are oxids resulting from fluxes.

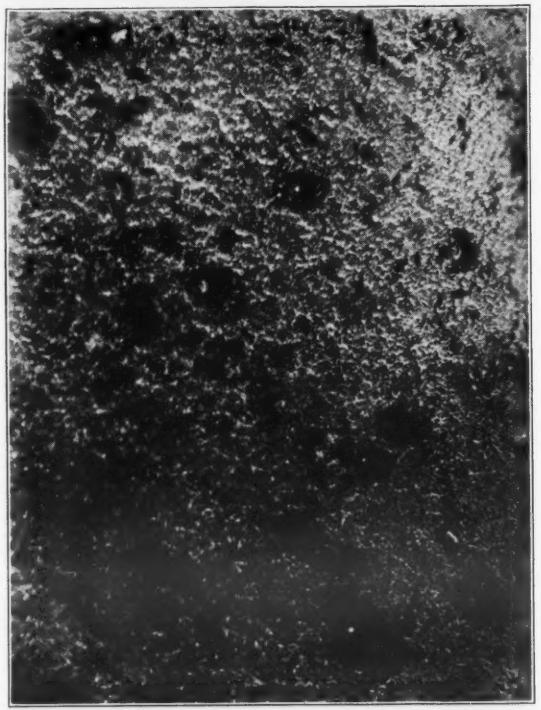

Fig. 13.—Microphotographs of S. S. White M. F. porcelain condensed by vibrating in paper matrix; first firing to 2,000 F. for three minutes; second firing to 2,100 F.; held at 2,100 for six minutes; glazed at 2,150 F.; held at 2,150 F. for twelve minutes. The specimen shows no air spaces and uniform structural arrangement.

Fig. 14.—Microphotograph of S. S. White H. F. porcelain condensed by spatulating method; fired as described in Figures 11 and 16. There are small air spaces and fairly uniform structural arrangement.

lucency. If this stage is prolonged to too great an extent, there is an increase in porosity and deformation takes place.

The time factor is equal in importance to the heat factor in the firing of ceramic materials. A method should be followed in which accurate timing under all conditions may prevail.

Timing the firing before the vitrification stage is unimportant, provided the furnace is allowed to heat up slowly from 200 F. to the beginning of the chemical stage, 1,800 F.

Fig. 15.—Microphotograph of S. S. White M. F. porcelain, condensed by whipping method; fired as described in Figure 13. There are several air spaces and a lack of uniformity of structural arrangement.

At the beginning of the chemical stage, the timing must be followed accurately, if the desired result is to be obtained.

In some of the tests that have been made, by following a scheduled time and decreasing the glazing temperature of the porcelain, the microscope shows a denser porcelain with fewer air spaces. The tendency to deform is less than when the temperature is brought up to a definite glazing point. (Figs. 11-15.) The temperature range used for these tests is shown in Figure 16.

The specimen was placed in the muffle below 200 F., and the temperature allowed to increase with the muffle door open, to 1,400 F. The muffle door was then closed, and the heat raised slowly to 1,800 or 1,900 F. The temperature was

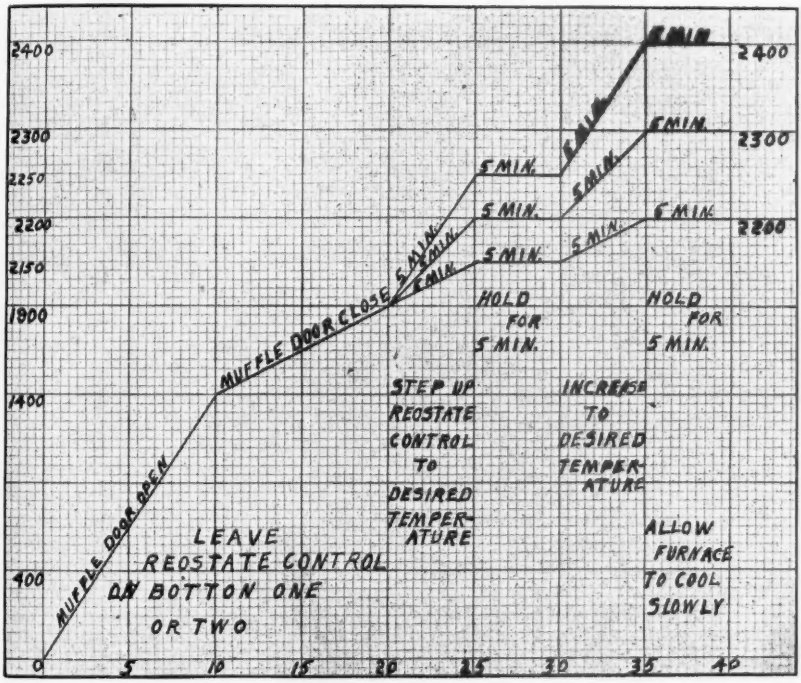

Fig. 16.—Method of timing the firing or glazing of dental porcelain. Justi H. F. porcelain was glazed at 2,400 F.; S. S. White H. F. porcelain, at 2,300 F.; S. S. White M. F. porcelain, at 2,200 F.

then increased gradually to 2,150 F. in five minutes. The pyrometer needle was then left at 2,150 F. for five minutes. The temperature was then raised gradually to 2,300 F. in five minutes and held at this point for five minutes. Then the current was shut off and the muffle allowed to cool slowly to 200 F. before removing the specimen.

Allowing the muffle to cool slowly anneals the porcelain and also permits the particles to arrange themselves in their natural position. Slow cooling or annealing increases the strength and decreases the porosity of the porcelain. To obtain a strong, translucent porcelain, the same precautions should be taken in cooling as in firing porcelain.

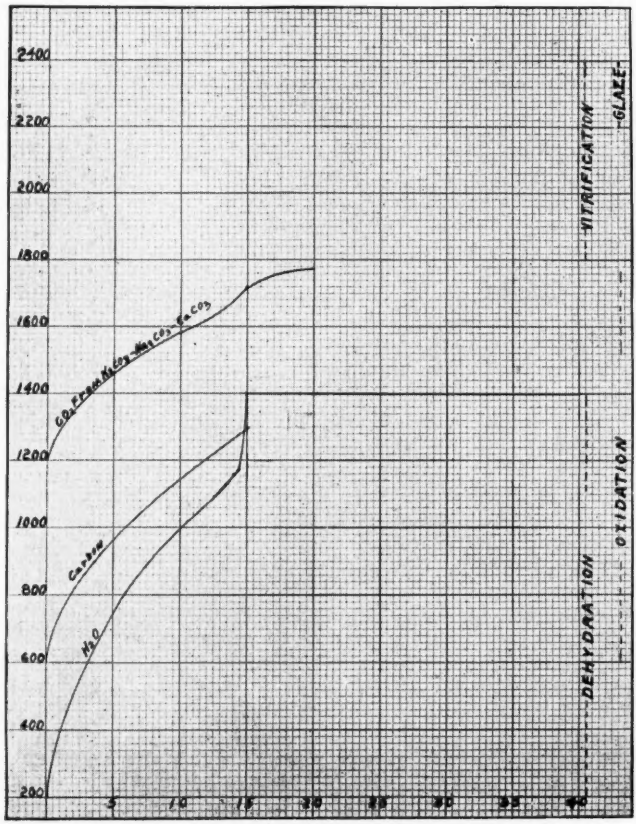

Fig. 17.—Approximate removal of water and volatile material.

BILATERAL ORTHOPLASTY: CASE REPORT*

By E. C. HUME, D.D.S., F.A.C.D., Louisville, Ky.

History.—M. C., a housewife, aged 36, first seen, June 5, 1929, complained of inability to open the mouth. She had had the usual childhood diseases without complications. At the age of 20 she had typhoid, and was very ill, with extremely high fever. After the crisis, she experienced inability to open the mouth. This condition had persisted since that time, a period of sixteen years.

Examination. — Roentgenograms revealed definite bony ankylosis of both temporomandibular articulations.

Operation.—The patient was admitted to the hospital, June 5, and was operated on, June 6. Sodium-amytal, 7 grains, was given intravenously and gas-oxygen administered. An incision over the condyle was made on the left side, care being taken not to sever the facial nerve, and a flap reflected; a gigli saw was passed around condyle neck and the condyle neck divided. The same procedure was instituted in passing the saw lower and removing about one-half inch of the neck of the condyle. The condyle head was not disturbed. A portion of muscle flap was placed between the ends of bone and sutured, the flap put in position and the wound closed. This procedure was repeated on the right side.

Outcome.—The mouth could now be easily opened. Small mouth props were placed between the teeth, the patient was put to bed and ice packs were applied to each side of face. No complications developed. The patient left hospital on June 25.

I have heard from this patient at intervals since the operation. She has had an uneventful recovery. The teeth have all been removed. She is now wearing full upper and lower dentures.

DISCUSSION

R. F. West, Seattle, Wash.: I should like to report a case of a girl, aged 14, who had never been able to open her mouth, so her mother told us. The teeth were decayed and the upper and lower gums were grown together. There was a little depression through which the patient was fed. I have taken the case up with Dr. Dean and eventually we are going to operate. Dr. Dean has a solution which he believes will establish the cause of this condition.

O. T. Dean, Seattle, Wash.: About twelve or fourteen years ago, we operated in a case of ankylosis, using a technic similar to that of Dr. Hume's, and we erred apparently in leaving some periosteum between the head of the condyle and the ramus. For about four years, there was very good action, but later on it was necessary to operate again. We found the bone approximately a little larger than a good sized lead pencil. We operated six years ago for the second time. My belief is that the condition was due to infection. Referring to the child who was not able to open her mouth before her teeth began to erupt: I believe that was caused by crushing of the head during delivery. In both these cases, roentgenograms verify that belief.

*Read before the American Society of Oral Surgeons and Exodontists, Evergreen, Colo., July 19, 1930.

SURGICAL CORRECTION OF ABNORMAL FRENUM LABII*

By ALBERT D. DAVIS, D.D.S., F.A.C.D., B.Sc., M.D., San Francisco, Calif.

THE question of proper procedure in cases of abnormal frenum labii concerns orthodontist, prosthetist and oral surgeons alike. Since the frenum occupies such a conspicuous position in the mouth, any abnormality affecting it causes a resultant abnormality of the dental arch when the teeth are present. The extreme separation of the central incisor teeth is unsightly and causes a lowered resistance of the gingival tissues.

Abnormalities of the frenum seem to have a hereditary tendency, a large number of cases showing a familial trait. Early correction in children is advocated to prevent irregularity of the front teeth.

Various degrees of abnormality are found, ranging from a moderately low set tip of medium width to a very wide fan-shaped mass with an attachment on the palatal surface, behind the central incisor teeth near the rugae.

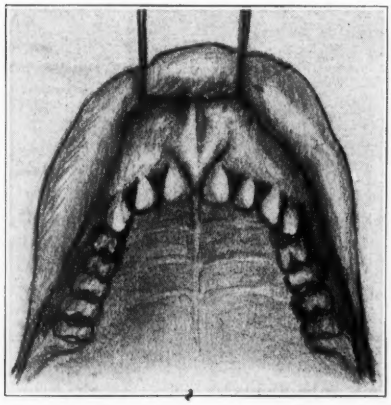

Fig. 1.—Abnormal frenum with attachment extending between the central incisor teeth.

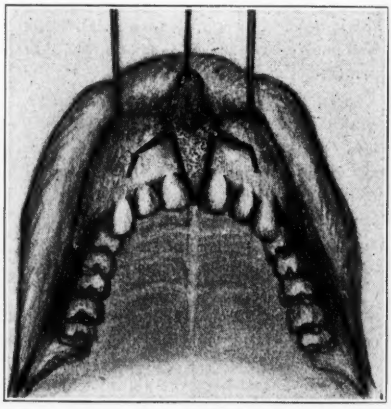

Fig. 2.—Incisions made and frenum lifted up with tissue hook. If necessary, at this point, the nasal spine may be trimmed. The incisions include the entire thickness of mucoperiosteum.

From the orthodontist's standpoint, the incisors can never be permanently retained in normal position, even when the space between is closed, until the mass between the incisors has been removed. The prosthetist finds a different

*From the Department of Plastic Surgery, Leland Stanford Medical School.

problem to contend with in those cases in which the frenum is set abnormally low or is unusually large. If the frenum is unsuccessfully operated on, partial failure usually occurs in the restoration from a cosmetic standpoint.

Attached as it is to the nasal spine, the frenum spreads out fanwise and acts as a control to the amount of vermilion border exposed. It likewise limits the mobility of the lip in the midline. When it is totally excised in edentulous mouths, and a denture is inserted, a bulging of the lip occurs just below the nose where the normal depression exists. Moreover, the vermilion border has a tendency to invert or turn under, which gives a very unnatural appearance to the lip. If the abnormal frenum remains, not only is the denture weakened when sufficient material is cut out to allow for it, but the movement of the lips in speaking or in various facial expressions tends to dislodge the denture and cause embarrassment to both patient and prosthetist. Various means have been employed to correct the abnormal frenum labii. The operation depicted in the accompanying drawings has proved very satisfactory.

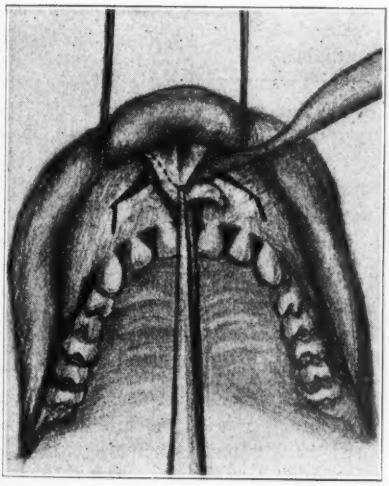

Fig. 3.—Excision of redundant tissue from the apex of the frenum. The flaps on either side are undercut far enough that they may be brought together in the median line.

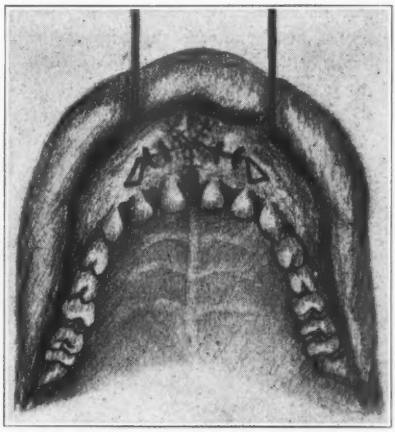

Fig. 4.—Frenum repositioned and wound closed with horsehair.

PROGRESS REPORT: RESEARCH ON DENTAL MATERIALS: THE RESEARCH PROGRAM; COOPERATIVE WORK ON INLAY CASTING TECHNIC*

By N. O. TAYLOR†, Ph.D., Washington, D. C.

THE RESEARCH PROGRAM

A GENERAL outline of the field to be covered by the cooperative research program sponsored by the National Bureau of Standards and the American Dental Association was presented at the annual meeting of the Association in Washington in 1929. A detailed program for the year 1929-1930 was subsequently approved, as follows:

1. To continue the amalgam investigation, i. e., study effects of variations of technic in the manipulation of dental amalgams.

2. To study the problems of the inlay field, including (a) a survey of current inlay golds; (b) development of specifications for inlay golds; (c) a study of accessory materials and their effects on inlay casting: (1) a survey of current inlay pattern waxes and development of a specification therefor, and (2) a survey of current inlay investments and development of a specification therefor; (d) development through the cooperation of a large group of selected dental practitioners, of a practical standardized inlay technic based upon the scientific data now available.

3. To study the problems of the metallic partial denture field, including (a) a survey of impression materials and development of specifications therefor; (b) a survey of model materials and development of specifications for the same, and (c) development through the cooperation of a large group of selected dental practitioners, of a practical standardized technic based upon the scientific data available.

4. To give attention to the educational phases of the research. In addition, work is contemplated in the following fields: (a) dental cements, including synthetics; (b) dental porcelains, and (c) plastic denture materials.

The present status of this program at the end of the year is as follows:

1. The effects of variations in amalgam technic were studied. The results of this study were presented at the annual meeting of the Massachusetts State Dental Society in May, 1930.[1]

2. Standard samples of dental amal-

* A Report to the Research Commission of the American Dental Association.

* Cooperative research by the National Bureau of Standards and the American Dental Association.

* Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

* Read before the Section on Partial Denture Prosthesis at the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 23, 1930.

† Research Associate for the American Dental Association at the National Bureau of Standards.

1. Taylor, N. O.: Amalgam Technic: Dependable and Dangerous Practice, J.A.D.A., 17:1880 (Oct.) 1930.

gam alloys for physical and chemical tests were distributed to a number of laboratories that stated that they were equipped and willing to conduct commercial tests of this type of material. The laboratories submitted the data obtained through their tests and these were compared with established data on the same materials. Changes in manipulation or methods were suggested when necessary and the work continued until satisfactory evidence was obtained of the laboratories' ability to properly test dental amalgam alloys. Three laboratories are now listed as being qualified to do test work on these alloys. Other laboratories may be added to the list from time to time, and the names so listed are available on request to those interested in having tests made.

3. Samples of inlay golds are now being accumulated and the work outlined for this type of material will be inaugurated soon. The time required to complete the study of inlay golds will be considerable, and it is not likely that results will be ready for publication before the next annual meeting of the Association.

4. Studies have been made of the current casting investments and inlay casting waxes. The physical properties of these materials are discussed in detail and suggested requirements outlined in papers which are to be presented later in this program.

5. A large cooperative committee has been appointed, and work is in progress toward outlining an inlay technic which is both scientifically sound and practical. The work of this group will be discussed in greater detail in the latter part of this presentation.

6. A similar group has been appointed to consider the problems involved in the production of cast partial dentures. This study has just begun and at this time there is little to report on the results obtained.

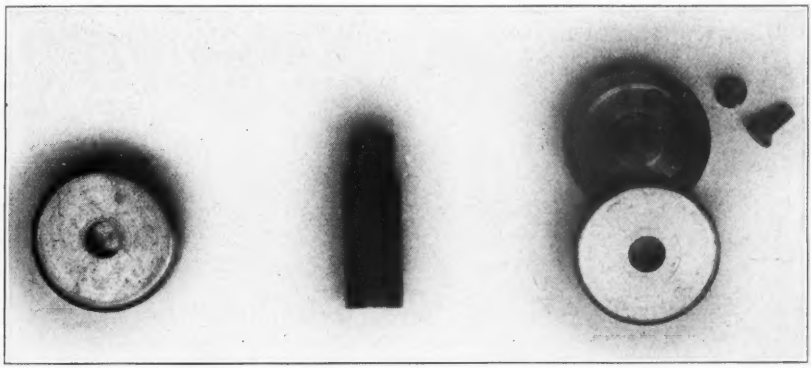

Fig. 1.—Types of dies used by cooperative committee.

Laboratory studies of the partial denture problems were made in 1928-1929, and a summary of the results given late in 1929.[2] In connection with these studies, the physical properties of a considerable number of impression com-

2. Taylor, N. O.: Progress Report on Research on Dental Materials (II), J. A. D. A., 17:775 (May) 1930.

pounds were determined. A discussion of the data obtained and suggested requirements for impression compounds will be presented in another paper later in this program.

7. The personnel available to carry on the laboratory work has been too small to warrant starting work in the other fields outlined in the program. The items on this program at present unfinished will be continued through the ensuing year.

COOPERATIVE INLAY PROJECT

A cooperative committee was appointed late in 1929 to study the inlay field. A considerable mass of data on the physical properties of dental materials as well as those data which were obtained in the study of inlay technics previously mentioned was available for their consideration. It was proposed that this committee first thoroughly familiarize itself with all of the factors entering into the production of a satisfactory cast inlay and that, having done so, it proceed with a practical study of inlay technics with the aim of selecting one which would seem best suited to the needs of the profession.

The work of the committee is by no means complete, but the data obtained in the preliminary work seem of sufficient interest to outline the progress of the work to date.

The cooperative group were supplied with two types of brass dies for use in making test castings (Fig. 1). One of these was made in two pieces and had a tapered cylindrical cavity in the upper section. The bottom section was detachable and, on removal, it became possible to estimate the shrinkage evidenced by castings by forcing them as far as possible through the cavity and noting the amount they projected through the die. The known taper made it possible to calculate the variations in percentage. The second die was so made that the wax patterns produced on it were similar to cast crowns in general shape. The upper part of the die was cut with a known taper, and the size of castings could again be estimated by noting the extent to which they failed to go to place on the die.

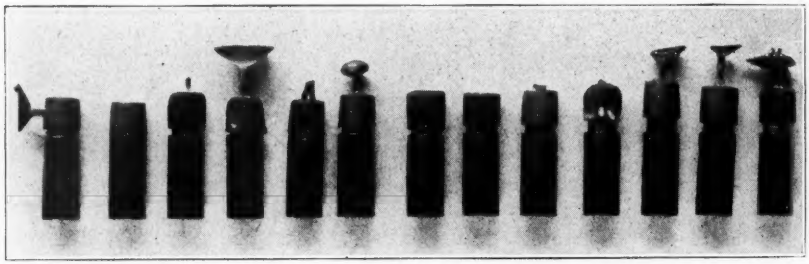

Fig. 2.—Typical crown castings made by a variety of inlay technics.

Difficulties are encountered in making gold castings to fit dies of these types. The taper is small when compared with those used in cavity preparation, and there is no overhanging margin to conceal slight discrepancies in the final product. Castings made by most casting processes now advocated will fit the occlusal type of cavity very loosely since the processes do not completely compensate for

the casting shrinkage of gold. Similarly, we find that castings made by the same processes for the crown die will seldom go to place because of the same failure to compensate for the shrinkage of the gold.

The cooperators were first asked to make castings for the dies by the technic that they used in their practice. This request served to illustrate the accuracy of the castings obtained by the usual technics, on the assumption that the committee represented a general cross-section of the profession and also gave a reference or starting point to which later results could be compared. Figure 2, showing a representative group of castings submitted by the committee, bears out the statement that the ordinary casting technics do not properly compensate for the casting shrinkage of gold.

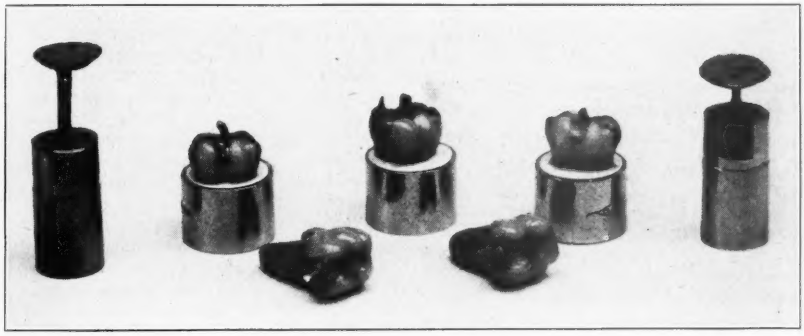

Fig. 3.—Typical castings made by the cooperative committee; christobalite investment; no wax expansion. (Castings as they came from the mold.)

The second portion of the work of the committee consisted of a study of the literature relative to the fundamental scientific factors which underlie the inlay casting problem. They considered the variables entering into the casting process and the proper method of balancing these factors in outlining an inlay technic.

A series of problems gave practice in selecting data and materials to give definite results. Analyses were made of the various casting technics found in the literature.

The next major topic considered was choice of materials. Under this head, the various materials entering into the casting process were first discussed and then experiments were carried out to demonstrate the properties of various types of materials as well as the effects of variations in manipulation.

The next major step in the study consists of a series of experiments on various technics of wax and investment expansion. This portion of the work was started late in the spring and would have been fairly well advanced had not the abnormal variations found in certain brands of investment materials as purchased in different sections of the country caused a great deal of confusion and delay.

The final set of experiments carried on just prior to the discontinuance of the work until after the annual meeting of the Association consisted of work with

a new type of casting investment which was developed at the bureau by W. T. Sweeney and George C. Paffenbarger. This material, whose properties are discussed in connection with other casting investments in another paper, has sufficient thermal expansion to compensate for the casting shrinkage of gold. This makes it possible to carry out the inlay casting process without the use of any wax expansion and eliminates the necessity of using any complicated technic or "special" equipment. The cooperative committee have had very good results with this material. A few of the castings produced with it are shown in Figure 3.

This work is to be continued through the coming year and it is hoped that the committee will be able to recommend to the dental profession a simple, practical inlay technic which will make it possible for the general practitioner greatly to increase the quality of his inlay work.

DISCUSSION

Wilmer Souder, Washington, D. C.: The papers which these research associates have presented afford an excellent idea of the scope of work which is being done in the cooperative program of the Bureau of Standards and Research Commission of the American Dental Association. It happens that the problems in which we are interested (standards for materials and proper technics) are the same as those interesting the American Dental Association. It is fortunate that we have been able to coordinate the work. Your grant of about 25 cents a member is administered by your Research Commission and not one cent of the total grant goes to the Bureau of Standards or to any member of the Bureau. Your research associates are not required to do any government testing but confine their operations to the program outlined by the Research Commission. The government appropriation is likewise administered according to a definite program and no part of this appropriation goes to the Association. Your representatives, Drs. Taylor and Paffenbarger, are well qualified for this type of work. Dr. Taylor, by reason of his excellent training in metallurgy and his contact with the dental courses as instructor at the State University of Iowa, and Dr. Paffenbarger, the son of a dentist, himself a licensed dentist, and teacher at Ohio State University, give you a research service which cannot be excelled. Their methods of research are standard, their conclusions are well thought out and the dental or practical applications are evident. I want to discuss for a few minutes some general items relating to the Bureau's work in general and then more specificially to these papers. A warning should be given against attempts to overemphasize some one property of a material above all other properties. For example, one of the reports of dental research conducted at the Bureau of Standards showed a number of brands of amalgam alloys complying (at the date of testing) with a federal specification. Within the last year, we have seen this report used to imply superiority because of a high crushing strength, or a low tin content, or an absence of tarnishing of the hand, or, finally, because the report was made by a representative of the American Dental Association stationed at the Bureau of Standards. A more sane conclusion and the conclusion intended in the report is that certain types of alloys, indicated as passing specifications, will give satisfactory service if properly used by the dentist. You are now interested in being advised as to what means are used to guarantee a continuance of compliance beyond the date at which the test sample was purchased. This information must come from the producers of these alloys. A further service can now be furnished, a service which you may never see but for which you should nevertheless be thankful. As far as possible, and where permitted, your associates will read papers submitted to THE JOURNAL for publication prior to acceptance by the editor. Numerous errors in conclusions, lack of supporting data, irrelevant material and apparent sales propaganda are pointed out by these associates, and, where necessary, corrected data or references to standard tests are given. This, if utilized to the fullest extent will save you hours of effort trying to follow imaginary research. Most dentists' laboratories have private "museums" housing numerous appliances and devices which they have tried and discarded. There is a humorous aspect to this when we think only of their having been painlessly

separated from $50 or $100 each time they have invested. There is a laudable aspect to it when we think of how eager they have been to try to equip themselves with the latest and what they regarded as the best for their practice. There is a sad aspect when we investigate and find the article to be the medium through which a keen (perhaps "ethical") member of the profession or organization, recognized by the profession, has, without data or justification, other than financial, swindled these members. This exploitation of the profession should be stopped. I believe this research program will prove to be very effective in this field. There are inconveniences associated with, and objections to, all the inlay technics advocated during the last twenty years. In 1926, we showed castings made to exact dimensions and fitting perfectly, by using a thermostated air bath and carrying out all operations at exact temperatures. The exacting details are too severe for most office laboratories and are therefore not to be insisted on as suitable for all conditions. Numerous modifications of the original Van Horn water bath have been proposed, but these have objections, e. g., a mesioclusodistal wax pattern is packed in a mass of investment and is supposed to push back the stiff investment as the wax pattern expands and as the investment solidifies. Thin sections on the pattern are supposed to force back this investment without any distortion whatever to the pattern. It is difficult to see how this can be accomplished in all cases. Expansion of wax patterns is sometimes secured by pouring warmed investments over the patterns, but this is subject to enormous variations. Inlays cast in thin wall sections and of soft material may be forced and burnished to the cavity in excellent adaptation, but there would undoubtedly be advantages in casting to more nearly accurate dimensions and not having to do so much stretching and burnishing. You have listened to some new ideas: perhaps these may prove satisfactory in the laboratory. Just now, we are not sure how they will be received by the profession. Next year, we shall be able to give you a definite report on their adaptability to your own laboratory. I know may of you are disappointed in not finding in these essays the last word on all dental problems. If you have observed an emphasis on the necessity for data on the physical properties of materials and an attempt to show the application of these data to dental operations, we are quite satisfied. When all of us begin studying the problem in this manner, we shall find the answer more quickly and at less expense than by any other method. This will require time—perhaps five years, possibly twenty-five. The value will be many times the cost. The latter we shall soon forget, but the former shall be the contribution of this generation to dental science.

A CONSIDERATION OF A NEW STEP IN ORTHODONTIC LEGISLATION

By HAROLD JUDD NOYES, Ph.B., D.D.S., B.S., Chicago, Ill.

ARIZONA'S new law defining and regulating the practice of dentistry and orthodontia involves such important changes that a careful survey of the facts is due both the public and the profession. Such a survey demands a sober consideration of the problem. Snap judgments and random opinions based on old habits and old pruderies will handicap rather than advance scientific progress.

This legislative step has been the result of a serious and careful study conducted by a few men over a long period of time

Author's note — As this article was prepared in the spring of 1930, minor changes may have been effected in the curriculums of the dental schools considered, but to the author's knowledge, none materially affect the tables or percentages given in this paper.

and of the endorsement of their judgment by more than a majority of the men practicing dentistry and orthodontia in the state. The action taken in the State of Arizona should not be judged without a comprehensive and analytic study of the law and of present conditions in the teaching and practice of dentistry and orthodontia.

The statistics, tables and data which follow are offered in neither approbation nor disparagement of the Arizona Law, but are submitted as a part of the evidence which must be gathered if the profession is to arrive at a rational decision regarding the problem. For this reason, I have divided the material into, first, a report of factual and statistical data gathered as pertinent to the question, and, second, a consideration of some relationships which seem significant. The former is in the nature of physical findings which may be verified by a similar examination of sources of the statistics; the latter, of diagnosis, which may or may not be accepted as logical.

I

ANALYTIC AND STATISTICAL MATERIAL

In gathering any data of this nature, it is necessary to follow some plan or outline. The one adopted is essentially a tabulation of the points which, in an effort to appraise this law, seemed of importance. They are as follows:

1. What does the law say?
2. What was the attitude within the State of Arizona toward the bill?
3. What is the prevailing requirement of dental schools?
4. What is the legal requirement of other state governments?
5. What means are available for securing special knowledge in orthodontia?
6. What means are available to insure the possession of special knowledge by specialists in orthodontia?

1. What does the law say? The following is given as a brief summary of the amendments to the previous law defining and regulating the practice of dentistry in the State of Arizona:

Section 2541 defines the practice of dentistry and the practice of orthodontia and makes the practice of either without a license a misdemeanor.

Section 2542 is concerned with "Dental and Orthodontia Examiners" and provides a board of five dentists for the purpose of examining and licensing dentists within the state, and further provides for the licensing and examining of orthodontists by a body constituted of the five members of the dental board and two practicing orthodontists in the state.

Section 2543 outlines the organization of the board of dental examiners.

Section 2544 deals with the eligibility of applicants for license.

The essential dental requirements are: license to practice in another state, or a diploma from a reputable dental college or university.

The essential requirements for orthodontic license are: residence in a college or university and completion there of courses in the following subjects: chemistry, 10 units; zoology, 8 units; physics, 8 units; English, 12 units; mechanical drawing, 2 units; "graduation from a school, college, or university approved by the Board of Dental Examiners of Arizona offering at least 3,400 hours of resident study including the following minimum requirements": anatomy, histology and embryology, 10 to 15 per cent; dental anatomy and comparative anatomy, 6 to 8; physiology, 3 to 4; dental pathology and rhinology, 3 to 4; dental science and metallurgy, 3 to 4; art, roentgenology

and photography, 1 to 2; orthodontia, 53 to 63; or practice of orthodontia exclusively in some other state for five years prior to the passage of the act.

Section 2545 is concerned with examinations and exemptions. In dentistry, a theoretical and practical examination is required of those meeting the dental requirements, and the board is empowered to allow men who have practiced dentistry for five years 66⅔ per cent on their practical and 33⅓ per cent on their theoretical examination. Also they are permitted to exempt applicants who possess a diploma from a recognized school and a certificate from the board of dental examiners of the state in which they previously practiced.

In orthodontia, the section provides for both theoretical and practical examinations and exempts dentists practicing in the State of Arizona prior to the effectiveness of the law from examination provided they register with the state board of orthodontic examiners before 1934. Further, the section prescribes that students resident in dental school at the time of passage of this bill may be eligible to the examination provided they "have completed a one-year postgraduate course in orthodontia in a school, college, or university recognized by the state board of orthodontia."

Section 2546 refers to revocation of license. Section 2547 deals with accusation and hearing of charges of violation of the law. Section 2548 states the compensation of members of the board.

The foregoing summary has been compiled from a copy of the law and has been edited by members of the dental profession practicing in the State of Arizona.[1] Copies of the law may be procured from the secretary of the State of Arizona.

2. What was the attitude within the State of Arizona toward this bill? It is most interesting to learn the extent to which this law found favor not only with dentists, physicians and orthodontists but with business men, teachers, and parents as well. I had gained the opinion, which for some reason has become prevalent, that it had been foisted on the profession and the commonwealth. To gain some data other than hearsay, I communicated with Charles H. Tweed, Jr., of Phoenix, Ariz. Dr. Tweed has been sincerely interested in the law and has been kind enough to furnish me with a tabulation of the reaction among dentists which he found through personal interview. The following data given under Table 1 is a recapitulation of his statistics and a short comment on them.

TABLE I.—STATISTICS ON ARIZONA LAW.

Total number of dentists in Arizona	88
Dentists not interviewed	18
Dentists favorable to the law	60
Dentists against the law	7
Dentists undecided	3

"The total number of ethical dentists in Arizona at the time of the passage of this bill was, as far as I have been able to ascertain, eighty-eight. The distances between the towns were sometimes great and for that reason I was unable to see eighteen of this number. Of the seventy men that I talked to, sixty were for the measure, seven against and three undecided. The percentages of dentists interviewed would be: 85.7 per cent in favor

1. William J. Johnson, secretary of the Arizona State Society and member of the state board of dental examiners; Robert Dunlap; R. Dean Creamer, past president, Arizona State Society; John A. Lentz; H. H. Braxton; C. H. Tweed, Jr., secretary of the Phoenix Dental Society; C. M. Moore, president, Arizona State Dental Society; W. A. Baker, president, Phoenix Dental Society; Eugene McGuire, state board of dental examiners; R. K. Trueblood.

of the law, 10 per cent against its passage, and 4.3 per cent, undecided."[2]

3. What is the prevailing requirement of dental schools? The question which at once comes to mind is, how do the requirements of this law compare with those which, through their rather uniform inclusion in the curriculums of dental schools, we have come to consider essential in training men for the profession? To gather data on this aspect of the question, I obtained the 1928-1929 or 1929-1930 catalogs of ten representative dental schools[3] and analyzed the prerequisites and courses offered. Table 2 gives a summary of the prerequisites of these schools and of the law in Arizona.

Table 2 might be summarized by saying that the six-year schools require an average of two years of collegiate work, of which the major part of one year is comprised of electives. An average of the five-year schools indicates one year of collegiate work as a prerequisite, of which only a small part of the work is elective. And the Arizona Law requires one and one-third years of collegiate work, no electives being indicated.

In considering the curriculums of these schools, I have separated the courses into five general classes. Group I includes those which might, for want of a better term, be called fundamental sciences. In this division fall such subjects as gross anatomy, general histology, general pathology, physiology, embryology, bacteriology and the like. Group II contains subjects which pertain to the technical procedures of the general practice of dentistry exclusive of orthodontia. It covers operative and prosthetic dentistry, the crown and bridge, and ceramic course, extraction, etc. In Group III are placed courses in dental theoretical subjects, including dental histology, oral pathology, dental metallurgy, therapeutics, pharmachology, radiography, hygiene and similar courses. Group IV covers courses in orthodontia, both technical and theoretical. Group V includes electives, subjects which were of a general cultural nature and courses not commonly included in the dental curriculum.

The purpose of this classification was to gain some idea of the relative periods of time which representative dental colleges devoted to basic or general scientific and biologic subjects, dental technical subjects, dental theoretical subjects, orthodontia, etc., and to compare these to the percentage of time which the Arizona Law required in them. Some opportunity for error arises through the differences in definition of terms and hours in the catalogs and through the rather loose statements concerning courses in some of the school bulletins. To reduce the possible errors to a minimum, clock hours were adopted as the unit, and wherever semester hours were given in the catalog, they were converted to clock hours, as shown in Table 3. There is so high a degree of agreement in the percentage of time devoted to these groups of courses in the ten schools chosen that I am inclined to believe the amount of error is negligible.

Table 4 gives the average percentage of time devoted to each group by the ten schools and the average total hours for the dental course; also, a similar grouping of the subjects required under the Arizona Law.

2. Personal communication to author, dated March 17, 1930.

3. Baltimore College of Dental Surgery, 1929-1930; Columbia University, 1929-1930; Harvard University, 1928-1929; Northwestern University, 1929-1930; University of Illinois, 1929-1930; University of Iowa, 1928-1929; University of Michigan, 1929-1930; University of Minnesota, 1929-1930; University of Pennsylvania, 1929-1930; Western Reserve University, 1928-1929.

The University of Minnesota happens to have approximately the same number of hours as that required by the Arizona Law, and, for this reason, a comparison of the percentage of time devoted to the above mentioned groups is particularly interesting. (Table 5.)

4. What is the legal requirement of other state governments? Having made a survey of what ten of the dental schools consider a workable, if not altogether ideal, apportionment of the students' time, it is interesting to turn to the attitude of the state governments as represented by their several state boards. I am indebted to the College of Dentistry of the University of Illinois for the privilege of using data obtained from questionnaires sent to the state board of dental examiners of the forty-eight states in this country. Table 6 gives the questions asked and a tabulation of the answers received.

A consideration of the answers to questions asked in this questionnaire furnished some evidence of the place which orthodontia occupies in the picture as far as the state boards are concerned. Forty replies were received from the forty-eight questionnaires sent out. (This number does not include the State of Arizona.) I believe that this is comprehensive enough to be considered representative of the law in this country. As this portion of this paper is devoted to a presentation of factual material, I will reserve comment for the section devoted to that purpose.

5. What means are available for securing special knowledge in orthodontia? With many men devoting their entire clinical time to the practice of orthodontia, with a growing demand developing in the public mind for this service and with the almost unanimous recognition by state boards of the subject, together with the special emphasis placed on it by the new law in the State of Arizona, the inevitable question is, where are the men who wish to devote their entire practice to orthodontic cases to obtain sufficient knowledge and experience to justify this specialization?

As indicated in the foregoing tabulation, approximately 3 per cent of their time while undergraduates in the dental colleges is devoted to orthodontic theory, technic and practice. The dental schools have recognized this increasing need for

TABLE 2.—SUMMARY OF REQUIREMENTS OF TEN DENTAL SCHOOLS AND OF THE ARIZONA LAW IN UNITS*

	Chemistry	Biology	Physics	English	Mechanical Drawing	Electives	Mathematics	Foreign Languages	Total Units
Average of seven 6-year schools	9.3	5.0	5.3	6.9	.0	29.0	.8	3.7	60.0
Average of three 5-year schools	8.0	7.3	4.0	4.0	.0	5.3	.0	.0	28.6
Average of both groups	8.9	5.7	4.9	6.0	.0	21.9	.6	2.6	50.6
Arizona Law requirement	10.0	8.0	8.0	12.0	2.0	.0	.0	.0	40.0

*Units are considered as equivalent to semester hours, one hour of lecture or two hours of a laboratory course for sixteen weeks being one unit.

further training by providing postgraduate and graduate courses in the subject. Of the ten schools previously mentioned, seven list such courses in their catalogs. The time devoted to them varies from a few weeks to one year of residence work leading to a degree of master of science. There are, in addition, private schools of orthodontia which offer short courses, some full, some of part time nature. The dental societies have also attempted to assist in supplying this need by including courses in orthodontia in their study group programs.

Clinical experience and the apprenticeship method remain the chief training of the great majority of practicing orthodontists at the present time, and where

TABLE 3.—BASIS OF CONVERSION OF SEMESTER TO CLOCK HOURS

Type of Work	On Two Semester Plan, 16 Weeks		On Three Semester Plan, 12 Weeks	
	Semester Hours	Clock Hours	Semester Hours	Clock Hours
Lecture	1	16	1	12
Laboratory	1	32	1	24
Infirmary	1	48	1	36

it obtains, there is no existing method of judging its fitness or extent. As in the old preceptor system of dentistry, the training is good where the preceptor is a good teacher or the student a good pupil.

6. What means are available to assure the possession of special knowledge by specialists in orthodontia? It is also of interest to inquire into the available means of determining the fitness of those who desire to represent themselves as specialists in orthodontia. The law in forty-seven states requires a dental degree from a recognized college or university, which means, on the average, 3 per cent of the total school time spent in orthodontic study, and, in addition, the approval of the state board of dental examiners, which in most states may be given even though the candidate fail in the section devoted to orthodontia in the state board examination. The State of Arizona requires special training for one year of those graduating in dentistry from 1930 to 1934 and thereafter special undergraduate training. The American Society of Orthodontists has indicated its recognition of the problem by creating a board for the examining of orthodontists. This examination is not compulsory.

II

I have, in the preceding sections, attempted to present with as few comments as possible the data collected in an effort to obtain a basis for some opinion on the legal step which the State of Arizona has taken. Inadequate as this brief survey may be, I believe it furnishes some interesting and serious problems for consideration, if not a sufficient basis for at least tentative judgment. And, in the last analysis, all reasonable judgment is tentative. Any concept may be changed by new facts or by new relationships of old facts.

The essential purpose of law is the protection of society. It is from this point of view, together with its accompanying ramifications, that we should regard the Arizona Law governing the practice of orthodontia. Not so many years ago, it was possible for men to practice dentistry with very little preparatory training, and after some years of experience gained at the expense of their first patients, a great many of these men became good practitioners and a benefit to society. But some of those first patients objected and, after a time, society, through its regulatory mechanism, began to place certain restrictions and preliminary qualifications on the men who chose to render this service. At the time these laws began to develop, the teaching of dentistry was behind the

requirement of society. We have now progressed to the point where there are few if any recognized schools of dentistry which graduate any men who are below the standard which society through its laws demands. Indeed, most scholastic requirements are in excess of the legal criteria. This condition does not prevail as regards orthodontia.

A study of the foregoing data indicates that one may confine his entire attention to the correction of malocclusion after spending only 3 per cent of his time while in dental training on the more intimate consideration of this subject. Furthermore, he can do so in most states even though he fail in his state board examination in orthodontia, if he maintains a passing grade on the remaining questions which pertain to dental subjects, the practical phases and technicalities of which he does not use. When we consider that the public has been led to believe that through the present system of licensing of professional men, the state is, to a certain extent at least, endorsing these men as worthy of public confidence, I think we must, in all fairness, admit that their interests are not properly protected.

If we grant that there is need for greater protection of the public than is at present provided, the question at once arises, does the Arizona Law offer it? It is, of course, impossible to make any law retroactive. To impose requirements on men who have entered the profession when different conditions existed would be an injustice to them. Moreover, many of these men have, through years of experience, obtained a skill which adequately compensates for the lack of early training. It is protection of the first patients against the beginner which must be the concern of the law. By this means, those who in the future require orthodontic treatment will be safeguarded.

For these reasons, the Arizona Law permits men who are at the present time practicing dentistry to obtain a license

TABLE 4.—AVERAGE PERCENTAGE OF TIME DEVOTED TO VARIOUS SUBJECTS.

	I Fundamental Sciences Per Cent	II Dental Technic Per Cent	III Dental Theory Per Cent	IV Orthodontia Per Cent	V Electives, Miscellaneous Per Cent	Total Clock Hours
Average of ten schools.....	24.38	57.17	13.91	3.10	1.31	4,276.0
Arizona Law						
Minimum.....	13.00	0	13.00	53.00	21.00	3,400.0
Maximum*.....	19.00	0	18.00	63.00	0	3,400.0
	By allocating the 21 per cent of electives among the other groups as follows, a very comparable percentage results.					
Arizona Law.....	26.00	4.00	15.00	53.00	2.00	3,400.0

*By maximum and minimum is meant the greater and lesser percentage figure given in the Arizona Law. This does not mean that an applicant may not have more than the required number of percentage of hours. He cannot have less than the minimum.

from the orthodontic board if they apply before 1934; and it allows men who at the time of the passage of the law are in dental training to take examinations without possessing the prerequisites specified if they supplement their dental course with one year of postgraduate work in the specialty. After thus providing for the present profession and for those now engaged in training, it then requires the scholastic work reported in the summary of the bill for those who shall wish to enter on the practice of orthodontia in the future.

In considering these specifications, it becomes evident at once that what has been done is to substitute for the 50 to 60 per cent of time which the present dental schools devote to the more technical and practical phases of Dentistry (I mean here prosthetics, operative dentistry, extraction, root canal therapy and the like) a similar amount of time, devoted to the application of the fundamental sciences to the technic and practice of orthodontia. If we compare the preliminary requirement of the ten dental schools and the Arizona Law, we see that, in all essentials, the Arizona Law has a higher requirement than the dental schools. When we consider the content of the dental curriculums and the requirement of the orthodontia schedule, there is little change. In the fundamental sciences, the specification is slightly less, with a far larger provision for electives, which, if allocated reasonably, offers a possibility of providing a greater percentage of time in all groups except that of dental technic. It must be remembered also that legal requirements are seldom at the top of the standard—they are in the nature of average or minimal requirements, while those of the schools more nearly approach the ideal from a pedagogic point of view. There is nothing to prevent applicants from exceeding the requirements; they must not fall short of them. As before stated, the requirements of most dental boards with reference to time and subject matter are far below the great majority, if not all, of the dental colleges.

Thus, it becomes clear that what the Arizona Law says is, in essence, that one must have (1) as adequate preliminary preparation, (2) as broad a knowledge of fundamental sciences and (3) as much training in dental theoretical courses as in the past, but in place of meeting many and exact requirements in dental technic which are not used, he must have a similar knowledge of the theory and technic of orthodontia which he is licensed to practice.

TABLE 5.—COMPARISON OF UNIVERSITY OF MINNESOTA REQUIREMENTS WITH THOSE OF ARIZONA LAW.

	Group I Per Cent	Group II Per Cent	Group III Per Cent	Group IV Per Cent	Group V Per Cent	Total Hours
University of Minnesota	18.7	64.3	11.4	4.7	0.6	3,454
Arizona Law						
Minimum	13.0	0	13.0	53.0	21.0	3,400
Maximum	19.0	0	18.0	63.0	0	3,400

When we consider the answers to the questionnaire, a few facts are brought into clear relief. It is quite evident that questions in orthodontia are universally asked. There appear to be five of the forty states who require demonstration of ability by practical or technical performance. Many of the state boards failed to answer the question regarding the percentage of the total grade which the section devoted to orthodontia contributed, but of eighteen who did so, the average indicates 7.61 per cent, or more than double the percentage of time which the average of the ten schools gives to the subject. I think this point is worth considering. Either the state boards are giving this subject too much attention or the colleges, too little.

Another portion of the questionnaire which is interesting is Part 1 and Part 2 of the fifth question. Of the thirty-three states who answered the question, "Do you fail candidates in their state board examination who fail in orthodontia?" only six answered in the affirmative. It is on these data that I base the statement made earlier that men may specialize in orthodontia after passing state board examinations in which they have failed to satisfy the examiners that they are proficient in the subject. And only six of the twenty-two who answered the second portion of question 5: "If their grade is

TABLE 6.—RESULTS OF QUESTIONNAIRE.

Question	Yes	Per Cent	No	Per Cent	Unanswered	Per Cent
1. Do you ask questions on orthodontia?	38	95.0	1	2.5	1	2.5
2. Do you give separate examination in orthodontia (as is done in many states in operative dentistry dentures, anatomy, etc.)?	23	57.5	16	40.0	1	2.5
3. Is the examination: Oral	1	2.5	15	37.5	24	60.0
Written	36	90.0	0	0	4	10.0
Practical	5	12.5	14	35.0	21	52.5
4. What percentage of the total grade of the examination does the orthodontia portion contribute?	Eighteen gave usable figures, the average of which was 7.61 per cent					
5. Do you fail candidates in their state board examination who fail in orthodontia?	6	15.0	27	67.5	7	17.5
6. Do you modify your examination for candidates who intend to practice orthodontia exclusively?	1	12.5	35	87.5	4	10.0
7. Is the orthodontia examination made up of questions and problems written by men specializing in orthodontia?	9	22.5	22	55.0	9	22.5
8. Is the portion of the examination dealing with orthodontia graded by men specializing in orthodontia?	7	17.5	28	70.0	5	12.5

below 50 per cent in orthodontia?" answered "Yes"; which means that one may fail utterly and still specialize in this field. This can hardly be considered adequate protection of the public.

Only one state was found which altered its examination when it was known that the candidate intended to practice orthodontia exclusively. Many of the state boards indicated that no man had ever stated this intention when applying for examination. This is probably true, but it does not follow that he would not have done so if the information was solicited.

A small minority of the states indicated that the questions on orthodontia are formulated by men specializing in the field and, in a still smaller group, the answers are graded by orthodontists. I think this condition prevails rather commonly when there is an orthodontist on the state board. In these cases, the board approaches the condition required by law in Arizona. It is, of course, as absurd to require a detailed and technical knowledge of orthodontia of men who do not expect to practice it as it is to require little or no knowledge of it by men who do.

The condition as reflected by the answers to the questionnaire has arisen principally because the mass of orthodontic knowledge, both technical and theoretical, has gradually increased to a point where it is no longer possible to give it adequate representation in the dental curriculums. With this accumulation of fact and theory — this establishment of a point of view, if you choose—there has developed simultaneously a technic which is peculiar to orthodontia and which is not obtained by training or practice of what we generally consider dental technical performances. These circumstances, combined with a demand for this type of service sufficient to permit a growing group of men to devote their entire time to its practice, have brought about a condition which was not existent at the time the dental curriculums were developed and the state laws were formed, and for which neither adequately provide.

Recognizing this condition of orthodontic pedagogy, and the injustice which the entire situation inflicts on the public primarily and the profession secondarily, the State of Arizona offers this law as a constructive contribution to the solution of the problem. Nor has the action of the state been unpremeditated as the evidence in Section 2 indicates. There has been and there will continue to be conflicting ideas on the wisdom of the step which this southwestern state has taken.

It is a difficult thing for men to change a conception which has developed with them and is a part of them. Perhaps one reason for this is that men can rarely sufficiently divorce themselves from the details of professional machinery to contemplate its fundamental purposes. I think this applies particularly to those who have objected to the Arizona Law on the basis that it had taken orthodontia out of dentistry. The purpose of orthodontia is to treat a particular human deformity, and this demands the adequate training of individuals capable of performance with the least harm to the patients committed to their charge. The question is not one for consideration from the standpoint of an institution losing a chattel, but from the need of society to obtain a service with a minimum of waste and damage.

I should like to draw attention to a point of view which both the adherents and the opponents to the Arizona Law have, at least in their publications, overlooked. The treatment of disease and

deformity, regardless of its particular nature, requires certain fundamental knowledge which is common to all branches of the healing art, and other specialized knowledge which pertains more intimately to a particular field. It is undoubtedly true that dentistry, forced to develop its own individuality, has progressed more rapidly and developed more effective means of serving humanity than it could have done within the medical profession. It is also true that this separate development has been made at a sacrifice by both medicine and dentistry. Many men in both professions realize this now. Evidence of this growing conviction is furnished by the rapid increase in medical subjects in the dental curriculums and by the emphasis on dental concepts in the medical courses. It is further borne out by the cooperation of physicians and dentists on hospital staffs and in private practice, and again by the increasing number who take the time to procure a medical degree to fit themselves better for the dental, general or special practices. We are happily returning to the realization that all of us in the general and special departments of both medicine and dentistry have a common bond and should have a common knowledge of the fundamental sciences which assist us in treating diseases and malformations of the human body. This condition has progressed so far that some universities have identical entrance requirements and one or two years of identical curriculum for all students taking work leading to medical and dental degrees.

In the light of this development, I do not consider that orthodontia is being placed outside dentistry, but rather that this law marks further progress toward the point where those seeking degrees in dentistry, orthodontia, medicine and some specialties of medicine will start with the same requirements and devote their first two years to studying those fundamentals which are of general application, completing their courses by special instruction in the more intimate and technical phases of their respective fields.

I have attempted to present evidence which may be of assistance in forming an opinion on this important experiment, and I have mentioned principles which seem to me to be involved in the problem. This condition in orthodontic teaching and practice faces the profession of the entire country. Arizona is unique only in its recognition and manner of dealing with the situation. The solution proffered in this state may not meet the needs of others in every detail, but it is significant that the men in this locality have had the courage to recognize the problem and the integrity to work out a solution. The details are of small concern when the matter is faced squarely and honestly, without personal or traditional prejudice, and the solution is intelligently sought primarily from the standpoint of the best interests of the patient rather than the convenience and welfare of those who render the service.

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CLINICAL AND DIFFERENTIAL DIAGNOSIS IN VINCENT'S INFECTION

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THE clinical picture of a true Vincent's infection presents a strikingly characteristic set of signs and symptoms. In severe cases of the disease, the destruction will often extend into the deeper tissues, and bone involvement is a factor to be considered.

With an acute form of Vincent's infection, we find all of the cardinal symptoms of inflammation. The tissues are reddened and congested; there is a recession of the interproximal crests; pain is usually intense; function is impaired to a greater or lesser degree. The erosion of the gingival crests is characteristic of the disease. On clinical examination, the crests seem to be cut off at about the level of the alveolar process. The bone may or may not be exposed. The appearance of the tissues would lead one to believe that the crests had been snipped off with the scissors. The interproximal spaces are open and débris will collect in them. The ease with which hemorrhage may be stimulated is another characteristic of the infection. In most cases, if the lip or cheek is retracted, the tension on the tissues will cause hemorrhage.

Associated with the infection is a peculiar, fetid odor, resembling that associated with an acidosis, yet differing enough that it cannot be called a true acidosis odor. The patient will complain of a foul taste in the mouth, especially on arising in the morning. This taste persists, in spite of the use of mouth washes and sprays, as long as the disease goes untreated. The formation of a pseudomembrane is a frequent occurrence. This is more noticeable where we have lesions distributed over the mucous membranes of the lip, cheeks or throat. We believe that such lesions are secondary to the gingival lesions. They seem to be due to some break or trauma which allows an extension of the process from about the teeth. The character of this membrane is exudative. The lack of exercise of the part involved will also tend toward such membrane formation. Excessive secretion of saliva is a common symptom of the disease. The patient, in some cases, is actually drooling. The temperature is characteristic of an acute or subacute infection. There is a morning remission and an evening exacerbation. The usual thermometer reading will be around 100 to 102 F. We have seen some very acute cases in which the temperature has gone as high as 105 F. Many of our cases show throat symptoms of varying intensity. There is not a typical sore throat; on clinical examination there is apparently no inflammation. The patients complain about a dry, "raspy" feeling. All true cases of Vincent's infection will show some symptoms of malaise. This is so marked in some cases that the patient is forced to go to bed for a period of days.

During the past two or three years, we have seen but three or four cases of true Vincent's "angina." Such a condition was common shortly after the war period. Whether this drop in the incidence is due to the fact that the disease is recognized and treated before it causes the widespread lesions of the angina, we do not know. We believe that a gradual immunity is being built up toward the disease; at least, the more severe forms. True Vincent's angina is characterized by a complete involvement of the gingival tissues, the lips, the cheeks, the tongue, and the mucous membranes of the tonsillar and peritonsillar areas. Angina, taken literally, means pain. It was associated with Vincent's disease because it was believed that the constriction of the pseudomembranes caused this intense discomfort. With the angina form of the disease, we find all of the cardinal symptoms, much more severe than the ordinary Vincent's infection. The lesions are so extensive that the patient has difficulty in eating, swallowing, and even in talking. It represents the most acute and most dangerous form of the disease.

In making a positive diagnosis of Vincent's infection, from the clinical standpoint, there are many other infections of the oral mucous membrane which must be considered. A differential diagnosis is essential. Vincent's infection may run its course, concurrently, with another disease of the mouth. It may act as a secondary condition when the tissues have had their resistance lowered by some other local or remote condition. A good diagnosis is dependent on a consideration of the symptoms, local and systemic, microscopic and serologic, of any other disease which may simulate a Vincent's infection. The diagnosis will depend, also, to a great extent, on proper methods of history taking.

In making a differential diagnosis, the age of the patient is an important consideration. Whether the onset of the disease is sudden or gradual is a factor. Symptoms of inflammation and pain are valuable in reaching a proper conclusion. We must note the character of ulcerations if any are present. The location, size, shape, and consistency of the lesion and the character of the discharge from an ulcer may be of great diagnostic value. The lymph nodes draining the area must be subjected to examination. We must also note the various systemic symptoms. Headache, nausea, vomiting, fever and toxic reactions must be accounted for.

We have found that Vincent's infection will attack individuals of all ages. Most of our cases seem to classify themselves between the ages of 20 and 50. This may be due to the fact that this period represents the time of greatest susceptibility to the disease, or it may be due to the fact that the majority of the patients examined are grouped within this classification. The onset of Vincent's infection may be sudden. There does not seem to be any definite incubation period between the time of inoculation and the appearance of the lesions. Some cases give histories which seem to indicate that this period may be a matter of only a few hours. The symptoms of inflammation, and varying degrees of pain, are present with Vincent's infection. The pain is usually intense. The secondary manifestations of Vincent's infection which appear on the mucous membranes of the lips, cheeks and tongue are usually well-defined. The margins of these ulcers are circumscribed in outline and have a craterlike appearance. They vary in size from the head of a black pin to a dime. They are fairly soft in consistency and the mucous membrane

around them is usually very red and swollen.

Ulcers of Vincent's infection seem to have a tendency to bore deeper into the underlying tissues rather than to extend over a wide area. The process is gangrenous in character. The ulcers are usually painful. If the membrane covering the surface of the ulceration is removed, a bleeding surface remains. The cervical lymph glands are involved in many cases. We have never seen a case where the gland itself has broken down and become ulcerated. The milder forms of systemic disturbances seem to be usual with Vincent's infection. There is a general malaise, more or less fever, headache and, in some cases, definite nausea. These toxic symptoms may be explained as the result of the presence of the materials which are carried throughout the body by the blood stream. The nausea which is sometimes evident is usually the result of swallowing these toxic mouth secretions. Some patients are so affected that they are unable to keep food in the stomach. Some will show symptoms of kidney disturbance. In severe cases, these systemic factors may make it imperative that the patient be confined to his bed.

Some of the more important diseases to be considered when making the differential diagnosis are: syphilis, tuberculosis and aphthous stomatitis.

The primary lesion of syphilis is the chancre. This does not appear until at least three weeks after exposure to the disease and is usually solitary. It is a relatively painless lesion with an indurated base. There is usually an enlargement of the neighboring lymph nodes. This process is also painless. The primary lesions of syphilis may persist for some time if the disease is untreated.

The secondary lesion of syphilis is the mucous patch. These will be found in the mouths of individuals who have failed to secure treatment for the disease. A careful history in such cases will bring out the fact that primary lesions have existed. Serologic tests such as the Wassermann or the Kahn should be made to verify the diagnosis. In many of these cases, there is a symmetrical rash on the body. A dark-field illumination examination from the lesion may or may not show *Spirochaeta pallida.* A careful differentiation from *Spirochaeta microdentium* must be made. The mucous patch is rarely very painful.

The mouth lesions of tuberculosis first appear as small yellowish nodules. These later break down and ulcerate. There is no pain in the early stages, but as the disease progresses, discomfort gradually increases. The ulcers of this disease are usually well-defined and the edges have a beveled appearance. The mucous membrane around them is slightly paler than the tissue of the lesion. The lesions are everted and have an undermined appearance. Tuberculous ulcers may be single or multiple. The findings of the tubercle bacillus in smears from the lesions affords a positive diagnosis. Biopsy of the ulcer will give the characteristic picture of a tuberculous lesion.

The lesions of aphthous stomatitis appear as shallow ulcers having a yellowish white appearance and are extremely painful. They may occur singly or as ulcers distributed over the mucous membranes of the lip, cheek or tongue. The tip of the tongue and the mucous fold formed by the junction of the tissues of the cheek and that over the lower border of the alveolar process seem to be favorite sites for these lesions. These ulcerations usually occur as the result of digestive disturbances and are of short duration. They will be found both in mouths that have gingival infection and in those that

are free from other lesions. We have found that a single treatment with phenol, carefully applied, will usually clear them up.

Diabetic stomatitis must be ruled out through differential diagnosis. This form of stomatitis simulates Vincent's infection. The odor from the lesions is different. Diabetic lesions give a peculiar fruity odor. It may be chloroform-like in character. There may be a loosening of the teeth. The tissues have a redder hue than those of Vincent's infection and the tongue is usually somewhat enlarged and red. Fissures on the margins are also common. Here, again, a complete history will aid materially in eliminating other conditions. If there is any doubt in the mind of the operator, the patient must be sent to a competent physician for a complete physical examination, including a urinalysis.

Pemphigus is one of the rarer diseases displaying mouth lesions which closely resemble those of Vincent's infection. Pemphigus is characterized by the formation of bullae which tend to break down and coalesce into extensive ulcerative areas. These areas are indefinite in outline, and, in acute cases of the disease, will involve the mucous membranes of the entire oral cavity, the fauces and the respiratory tract. Most cases of pemphigus will show lesions elsewhere on the body.

Erythema multiforme will manifest itself in the mouth as small vesicles which break down and ulcerate. Treatment is difficult and recurrence common. The lesions are widespread and are characterized by a crusting over of the surface. The lips and corners of the mouth are usually involved. This disease will show vesicles or other skin lesions elsewhere on the body, particularly on the wrists and ankles.

Diphtheria must be considered in throat lesions. If there is any question whatsoever, the operator should send the patient to the physician for examination. Cultures should be taken of the throat, and if diphtheria organisms are found, antidiphtheritic treatment should be instituted. The membrane formed by the action of the Klebs-Loeffler bacilli is darker in color than that of Vincent's infection. It is closely adherent; whereas, the pseudomembrane of Vincent's is easily stripped away. The general symptoms of diphtheria are more acute than those of Vincent's infection.

Scarlet fever, in rare instances, may be responsible for ulcerations of the gingival mucous membranes, particularly where proper mouth hygiene is lacking. The tongue symptoms are diagnostic for scarlet fever. We find the so-called "strawberry tongue." The filliform papillae are enlarged and the tongue presents a marked reddening which is characteristic for the condition. The throat symptoms are unusually severe and pain is constant.

Scurvy, now comparatively rare, resembles Vincent's infection in its gingival lesions. It may involve the mucous membrane, and, in severe cases, the teeth become very loose and fall out. The general symptoms are more severe than those of Vincent's infection. There is a marked lassitude; palpitation of the heart may occur; there is pain in the limbs; high fever is common, and there may be an ecchymosis of the mucous membranes in scattered areas.

Various metals may produce gingival lesions, and chemical combinations of them may be deposited in the tissues. In such cases, a history of occupational conditions will usually give a clue as to the cause of the lesions. The color of the deposits will also aid. These conditions

result from the administration of small amounts of the metals over a period of time, rather than from a single large dose. Some of the metals which tend to produce such lesions are mercury, bismuth, copper, phosphorus and lead.

Certain drugs used for the relief of pain will cause eruptions on the oral mucous membranes. Many such eruptions may be confused with syphilitic or Vincent's lesions. Some of these are acetphenetidin, antipyrin and amidopyrin. We have seen one case in which the mucous membrane became rough and scaly and the scalp of the patient apparently exfoliated after the administration of large doses of acetylsalicylic acid.

Other conditions which may cause the production of gingival or oral lesions are pregnancy, menstruation, locomotor ataxia, nephritis and gout.

From the foregoing outline, we can see the importance of a complete history of each case. The necessity for thorough bacteriologic, microscopic and serologic examination is evident. We saw one case in which the individual was suffering from carcinoma. Since the growth had become very large, it seemed improbable that operative and therapeutic remedies would improve the prognosis. A smear revealed superimposed Vincent's infection. Treatment reduced the size of the growth about one-third. Treatment for the carcinoma was then considered favorable.

Vincent's infection may be a primary condition; it may be a secondary invader in practically any form of mouth infection, or it may run its course concurrent with another mouth condition. The operator must be familiar with the more common diseases of the oral mucous membranes in order to obtain a diagnosis which will facilitate the treatment of Vincent's infection or any other disease which may be present in the oral cavity.

"WHY ROOT CANALS SHOULD BE FILLED TO THE DENTINOCEMENTAL JUNCTION"*

By CARL J. GROVE, Ph.G., D.D.S., St. Paul, Minn.

IN the November issue of THE JOURNAL, William G. Skillen has presented a criticism, or perhaps more fittingly speaking, an arraignment, of an article of mine entitled, "Why Root Canals Should Be Filled to the Dentinocemental Junction." In his discussion, he denounces my views as mere theories, having no scientific basis, and utterly lacking in substantiation, as a succession of misleading statements and contradictions, and, in substance, without evidence of any value.

I believe in the value of criticism, but only when it is made in a spirit of fairness. I can understand that Dr. Skillen might disagree with my views, but I cannot understand his antagonism toward them, as is so clearly evidenced throughout his discussion. He requests that I give proof for all my statements and "substitute a few facts for opinions and

*A reply to Dr. Skillen's criticism published in the November issue.

theories," but in his efforts to disprove my statements, he offers only assertions with a tone of finality that challenges further discussion.

In reply, I wish first to consider the phrases, "definite junction" and the "irregular line of demarcation" in order to determine whether or not they are obviously contradictory. Since it is possible to have a definite regular line of demarcation, it is also possible to have a definite irregular line of demarcation; therefore, these terms are in no way contradictory. Dr. Skillen seems to imply that "definite" and "irregular" as applied in my discussion, are contradictory terms, but this conception is incorrect. There are two conditions described, a "definite" junction of the dentin and the cementum, but the junction is "irregular." It is possible to have a definite irregular line of demarcation of different substances that are in close proximity, provided they differ in character or color, and this is not confined to cementum and dentin. For instance, if a dark cement is placed on white cement having an irregular surface, there would naturally be a definite irregular line of demarcation of these substances. Likewise, when the cementum is

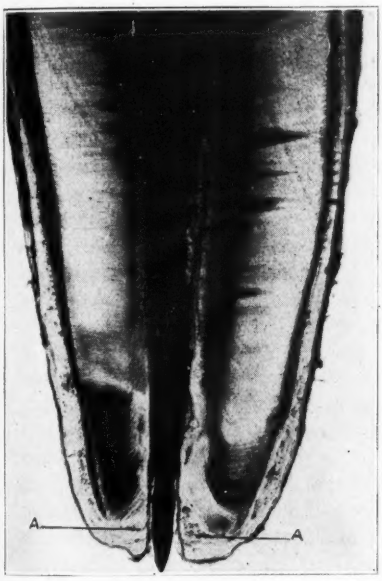

Fig. 1.—Section showing a definite junction of the dentin and the cementum *(A-A)* referred to in author's writings. The filling should not terminate short of this point. The purpose of the reamer in the canal was to insure cutting the section at the proper angle.

Fig. 2.—Section illustrating a definite junction of the apical dentin and cementum at the foramen *A-A*. There is no objection to filling extending into cementum but it should not terminate in the dentin. The canal curves at the foramen. *B-B*, line drawn at right angle to the canal at the apex, indicating the angle and termination of the root filling.

formed on an irregular surface of dentin, a definite irregular line is produced, owing to the difference in the character of these two substances. I trust that I have made my meaning clear on this point.

This controversy arose from my statement that a definite junction of the dentin and cementum existed at the apex. In my reply [1] to Dr. Orban's criticism [2] on this subject, I presented sections that conclusively substantiate the existence of such a condition. For further evidence, I wish to present additional sections to remove any doubt that may still exist. These are shown in Figures 1 and 2. In the preparation of the section shown in Figure 1, a fine reamer was inserted to the apex and the instrument retained in the canal until the grinding of the section was completed. This method was employed to eliminate any possible question as to the direction in which the section was cut. The specimens previously presented, of the apical dentinocemental junction showing surfaces at three points, were objected to by Dr. Skillen on the ground that they were inadequate. Bear in mind that it was the existence of the apical dentinocemental junction that had been questioned; therefore, I prepared the section in this manner because it more adequately disclosed this condition than sections that are cut centrally. The more area shown at the apex, the more clearly will this condition be demonstrated. It will be noted that the sections prepared centrally also prove that a definite apical junction does exist.

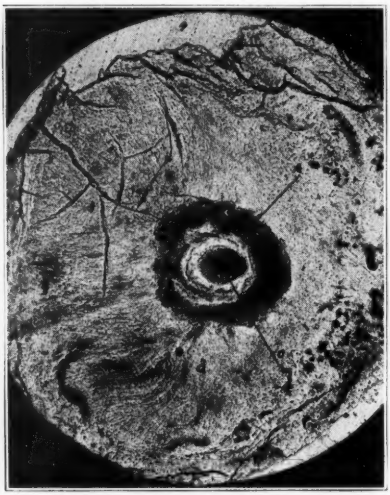

Fig. 3.—Transverse section of apex, illustrating that the foramen is formed by cementum, and that it is possible to have the end of the root filling surrounded by cementum. A definite junction of cementum and dentin will be observed. *A*, cementum; *C*, canal; *d*, dentin.

Dr. Skillen charges me with questioning the value of sections of material such as Dr. Coolidge [3] presented, and also presented by Dr. Skillen in his article, and states that I claim they are misleading, etc., etc. I must confess that I am greatly perplexed over this charge. In the first place, I am puzzled to know why he has even mentioned the illustrations presented by Coolidge in this connection, and, in the second place, I am puzzled to determine the similarity of the improperly prepared slides I have alluded to and those of Dr. Coolidge. In fact, I did not allude to sections of any individual, but to sections of my own, which, I have observed, when not properly cut,

1. Grove, C. J.: Further Evidence That Root Canals Can Be Filled to Dentinocemental Junction, J. A. D. A., 17:1529 (Aug.) 1930.

2. Orban, Balint: "Why Root Canals Should Be Filled to Dentinocemental Junction," J.A.D.A., 17:1086 (June) 1930.

3. Coolidge, E. D.: Anatomy of Root Apex in Relation to the Treatment Problems, J. A D. A., 16:1456 (Aug.) 1929.

are sometimes misleading, because of distortion due to concavity or convexity of the surface of the root as well as existing curvatures. Dr. Coolidge's slides have been cut after the manner I suggested as being correct for the study of this condition, namely, parallel with the long axis of the tooth. Also, as far as I can determine, they do not reveal the conditions that I have referred to as being misleading; therefore, there was no occasion for criticizing Dr. Coolidge's sections. I doubt if it is possible to obtain sections that will illustrate more clearly the structures existing in the teeth from which they were made. A definite dentinocemental junction is clearly shown in all but two of these sections.

In his argument supporting the fallacy of a definite dentinocemental junction, Dr. Skillen calls attention to "the type of evidence" I have offered to support my views to the contrary and refers his readers to illustrations that I presented of sections cut parallel with the long axis of the tooth. He here implies that this is an incorrect procedure. Now these sections were shown only for the purpose of illustrating the divergent foramen, the periodontal membrane and the pulp, as I clearly stated in the article where these appeared. "Moreover," he states, "they apparently represent teeth in which the roots have not been completely formed, not the finished structure." The word "apparently" is unnecessary in this case since I stated clearly that they were sections of teeth of youth. This type of tooth was presented because it is the only type that illustrates clearly the anatomy that I wished to emphasize and not for the purpose of misleading my readers. Quoting Dr. Skillen: "The tissues, too, are torn and distorted, so that their relationships are not clear, and on top of all this, details of structure are sadly lacking." I can only say that the structure I am seeking to explain and that I call attention to is the important thing in these sections, and this can be clearly observed even by the uninitiated. As to the sections, they were prepared for me at the Pathological Department of the College of Medicine of the University of Minnesota. In summing up his discussion, Dr. Skillen states: "To offer such material as proof of the general definiteness of a dentinocemental junction is, to say the least, very misleading." Since I have nowhere made reference to these sections in support of a definite cemental junction, I can find no justification for this remark. I wonder if this is a wilful misrepresentation or if it is an error on Dr. Skillen's part. In either case, it shows evidence of an indiscriminative reader.

In the next paragraph, Dr. Skillen refers to one of my previous articles in which I explain the point to which the filling should extend, and he states that "it rather behooves Grove to define it." I would refer Dr. Skillen to an article that I read before the Pennsylvania State Dental Society, May 16, 1929,[4] in which I state, "The general conception of the 'apical dentinocemental junction' is that it refers to the point of contact of the primary dentin and the primary cementum at the apex of a tooth. . . . The condition to which I refer is not such as is found where the cementum has been deposited in the foramen of the teeth of middle life or advanced age as is shown in Figure 1." A number of years ago, I called attention to the fact that a definite junction does not exist in some of these cases. This I have stated at various times, as is recorded in the dental literature. As

4. Grove, C. J.: Simple Accurate Procedure for Treating and Filling Root Canals, J. A. D. A., 17:1634 (Sept.) 1930.

to the age of the deposit of cementum in the foramen, that has not to my knowledge been determined, but when the filling is extended to the point that I have suggested, this condition need not be considered, and when this procedure is followed, teeth need not be "treated on an age basis."

Another point of disagreement to which Dr. Skillen calls attention is my idea concerning the healing of the pulp. I use the word disagreement advisedly, because it is necessarily a matter of disagreement only, since the point in question, to my knowledge, has never been satisfactorily proved either way. It is for this reason that I have repeatedly warned against the advisability of leaving pulp tissue in the canal that is to be filled, for, as I have stated, there is always an element of uncertainty in the process of this repair. In my article under discussion, I have dwelt at some length on this subject. Dr. Skillen says I have made the statement that the pulp, being an embryonic tissue, lacks certain cell characteristics on which the process of healing is dependent. He says further: "The next moment, he states that it is only by transformation of the pulp tissue into fibrous tissue that healing occurs. Obviously, we are again dealing with a contradiction, for if it heals at all, it must possess the essentials for healing." Obviously, the cause for the apparent contradiction, is the incompleteness of the quotation. If Dr. Skillen had read farther, he would have observed that what I said was, "and such results will not follow when large portions of the pulp remain." As I have often stated, when the fragments of the tissue are left, healing occurs by the transformation of this pulp tissue into fibrous tissue. Since it has never been possible to determine microscopically just where the pulp ends and the membrane begins, it is only reasonable to assume that there may be an intermingling of the periodontal membrane with pulp tissue at this point supplying the essential characteristics for healing, as Dr. Skillen has stated. Dr. Skillen goes on to say, "Grove further states that there is a sharp line of demarcation between the pulp and the periodontal membrane." I have no knowledge of ever making such a statement.

Dr. Skillen directs attention to the fact that types of teeth different from those previously used to illustrate the foramen, the periodontal membrane and the pulp were used to illustrate the dentinocemental junction. Since I illustrated two different conditions, it was necessary to use different types of teeth. This, Dr. Skillen must fully realize. I cannot understand just what he means to imply. However, there is no just reason for the attempt to discredit efforts of this character.

Of all the problems with which the dental profession has had to deal, perhaps the most important and also most complicated has been that of the pulpless tooth. Certain it is that it has received the least consideration. Other branches of dentistry have undergone regular stages of development until they have reached a satisfactory degree of efficiency, while the problem of the pulpless tooth, until recently, has remained in the embryonic stage. Consequently, thousands of teeth have been needlessly sacrificed yearly. This serious situation aroused the profession to the urgent need of a remedy. Unfortunately, as there was little knowledge at hand upon which to base a constructive study, they were forced to do their own investigating. When we consider the intricacies of this problem and the comparatively few men engaged in its study, the progress made has been very satisfactory. During this period, these men have, from time to time, published careful

scientific and beneficial reports of their investigations, until a point has been reached where the pulpless tooth can now be treated and filled by efficient and scientific methods with most gratifying results.

Dr. Skillen states: "All too frequently, articles are written in which statements are made which are not substantiated and in which theory becomes fact overnight. And nowhere does this appear to be so prevalent as in connection with the root canal problem." If it is true that articles on this subject have appeared in our journals that seem to lack substantiation they can, I think, be numbered with the occasional rather than the frequent. Furthermore, I do not believe that we should reject as worthless all matter that is not fully substantiated. Even theories and opinions are often of great value in attempting to solve a problem.

Dr. Skillen further contends that there is not a particle of evidence as to what lies behind the success or failure of the treated tooth and he also would discard all the numerous technics now in use as valueless. The truth of the former statement depends, of course, on how he estimates value. The value of treatment and technic must be estimated upon results obtained. The fact that we obtain success in the majority of cases by the methods based upon the result of these researches would indicate that the value of these procedures has been greatly underestimated by Dr. Skillen.

No one maintains that the problem is solved, but from what has been accomplished the prospects for a solution are encouraging and I cannot agree with Dr. Skillen that "to seek farther under the circumstances is only uselessly complicating an already complex matter"; especially in view of the fact that the results obtained by pulp canal operators are equal to those of any other branch of dentistry.

Progress will not only be retarded by the acceptance of Dr. Skillen's suggestion but a backward step will be made. It is only by the continuance of constructive contributions that advancement can be made regarding this problem.

CONTROL OF PAIN DURING OPERATIVE DENTISTRY PROCEDURES*

By P. G. PUTERBAUGH, M.D., D.D.S., Chicago, Ill.

THE sensation of pain is a common experience to all of the higher forms of animal life. It is the most distressing of all sensations; in fact, its unpleasantness places it foremost among the incentives for self-preservation. Its function is primarily protective, and its importance is realized when we consider that it is the signal which warns of danger and causes us to seek assistance when harmful influences are operating.

Pain is not of uniform kind or intensity, and it varies widely in the degree and quality of its perception. In fact, pain is interpreted only in the degree of

*Read before the Section on Operative Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

its recognition. Pain is not an afferent impulse—it is the perception or recognition of impulses.

The ability of human nervous systems to endure insult is widely variable in different individuals. Impulses which are regarded as being only mildly unpleasant by one person are often interpreted as severe pain by another, and, in the latter case, they produce characteristic pain reactions throughout the entire body. For that reason, the effects of varying degrees of pain can be measured only by studying the reaction of each individual and not by the extent of tissue injury or the anatomic parts invaded. Pain is purely subjective; it can be perceived only by the patient, who evaluates it by comparison with other familiar bodily sensations; but his comparisons may be distinctly unfair and biased by imagination and prejudice. As a trite example, a person who lives in the far north and is daily exposed to extreme rigors of cold during the long winters is not likely to experience the degree of pain sensation from a given tissue injury that would be felt by a person who has always been shielded from disagreeable conditions by basking in the lap of luxury. Patients who have once experienced distress in the dental chair are quite likely to be hypersensitive at subsequent sittings.

Of all ordinary sensations that the body experiences, pain is the one that is most injurious to the general health. It causes digestive derangements; it perverts secretions; it brings about endocrine imbalance and general exhaustion far in excess of that caused by fatigue or fright. In fact, the exhaustion that results from an hour in the dental chair is frequently so great that it takes several hours for patients to recover their normal equilibrium. That experience is frequently avoidable, and its prevention is worthy of every effort on our part. Researches on laboratory animals have demonstrated that most of the disagreeable sensations, including fear and anger, produce actual degenerative changes in the more important glandular organs of the body. These changes are especially evident in the liver and the spleen. A mild reaction to pain merely amounts to a feeling of fatigue or exhaustion, while deeper impressions bring about the more profound reaction known as shock. Pain then is interpreted in terms of its perception, and its injurious effects are not always in direct ratio to the amount of tissue injury. In fact, it is not uncommon to meet patients who have so sensitized themselves through mental anxiety that they interpret ordinary touch or temperature sensations as pain and suffer just as much from it as though the pain was real. Others there are who, through exercise of mental control, are capable of enduring rather severe operations without flinching or suffering fatigue by refusing to perceive or recognize pain impulses. Pain perception and its resulting damage is capable of being either minimized or magnified by voluntary mental effort. That is why suggestive therapeutics is so useful in assisting patients to shut out pain reception, but the reason it is not practiced more universally is that, while its results are eminently satisfactory with some patients, they are utter failures with others.

The convincing effect on an individual of repeated statements has been understood for centuries, but its concrete practice in medicine and surgery is relatively modern. In 1776, Anthony Mesmer wrote his celebrated essay on "Animal Magnetism." He employed a system of stroking the subject's body with the hands accompanied by repeated positive state-

ments to produce what he called "magnetic sleep" or mesmerism. Later studies of physical phenomena disclosed that this was simply a refinement in the application of hypnosis, which had been known for many hundreds of years.

Even a light stage of hypnosis changes the state of mind in some unexplained manner whereby the appreciation of pain sensation is greatly subdued or even abolished. Hypnosis can be employed in all varying stages from that of mentally shutting out pain impulses by a refusal to recognize them on down to the production of a deep sleep. Since Mesmer's day, it has been employed from time to time to produce surgical anesthesia, but its effect is not always uniform, and, with many patients, it is far from satisfactory. Many of the healing cults have been based upon it; of these, Christian Science being the most popular. The ability of Mrs. Eddy's followers to shut out pain is recognized by all and is undoubtedly the effect of suggestion, which establishes a condition of true hypnosis. Confidence is the foundation that all suggestive therapeutics must be built upon. Win the patient's confidence first and the rest of the way is easy. Suggest other substitute sensations when pain is to be produced. Interest them in the mouth comfort your work will give, and in all ways endeavor to take their mental focus from themselves and in every possible way reduce high tensioned nerves to a state of composure.

Pain sensations emanating from teeth are perceived so acutely that the phrase "painless dentistry" has been coined as an advertising slogan and is met throughout the world. Just because dental pains are so acute, "painless dentistry" is the most alluring promise that can be dangled before the eyes of the unfortunate sufferers and has proved to be the most effective business getter that publicity experts have yet devised for use in dental advertising. It is believed that the rational employment of the present array of pain relieving devices and methods is helping to deliver dentistry from the handicap of fear of pain, with which it has so long been saddled; and a good grade of dentistry can now be produced with even less pain than the inferior work which the advertising quack has for so long furnished under that slogan.

We need not burden ourselves with a discussion as to how or why dentin is sensitive, but may frankly acknowledge the fact that most dentin is extremely so. If we can judge accurately from the lay discussions frequently overheard, it would seem that the most dreaded operative dentistry procedures are in the following order: (1) excavation of dentin with burs and hand cutting instruments; (2) preparation of roots for the reception of crowns and bridge attachments; (3) pulp extirpation; (4) rubber dam adjustment; (5) scaling and polishing.

Two types of procedures put fear in the patients' hearts: one which produces severe pain, and another which may not be at all painful but is accompanied by so much noisy grinding that nerves are "put on edge," and the patient is literally "frightened out of his wits."

Careful instrumentation and a gentle touch will unconsciously reassure the patient and strengthen his confidence in the operator. In this frame of mind, he will place himself in the operator's care and relax to such a degree that even slightly painful sensations will cause little distress.

The vibration of engine driven instruments is universally dreaded. Elmer S. Best, in speaking on this subject before

the American Dental Association in Washington, said that, on questioning many patients, he received the reply that what bothered them was the fact that when they opened their mouths and the dentist began cutting, they were at his mercy and might be terribly hurt with no means of stopping him. In fact, if they tried to speak, they feared their tongues might be caught and seriously injured. They uniformly agreed that if some means were at their disposal whereby they could stop the engine, they would not be so much afraid. Dr. Best had constructed a stop-switch that was connected with the engine and fastened to the left arm of the dental chair. His patient holds this little pendent switch in his own hand, and if he feels that he is going to be hurt, or is actually hurt, he presses the switch and shuts off the motor. At first thought, one is inclined to feel that such an arrangement would interfere greatly with the progress of the work because the patient would be constantly stopping the engine. As a matter of fact, the reverse is true. After seeing that it really works, patients seldom use it and remain quite contented. Some patients just touch the button with slight pressure of the thumb, and the slight cessation of electrical current felt in the handpiece is the operator's signal to move the bur to another location.

A technic should be followed in all operating by which the work will proceed step by step in logical sequence. Thus, time is conserved and the patient's confidence held.

I have endeavored to make clear that the control of pain in operative dentistry must be approached from (1) the adroit management of patients whereby pain apprehension is abolished; (2) the employment of anesthetics and other methods of pain control to prevent the nerves from carrying pain impulses to the brain. An understanding and practice of both methods is very important.

Adroit management of the patient includes everything about the office from a dignified entrance hall, a simple clean reception room and an orderly, cheerful operating room, with quiet pleasant office attendants who show human interest in patients without reflecting their own personal feelings. Frivolity has no place in a dental office and certainly should never be permitted when patients are present. Be kindly and sympathetic at all times and assume the attitude that you are sorry defects have developed and will do your best under the circumstances to repair them. The adoption of an office rule of excluding all persons from the operating room except the patient and operator is most commendable for the very reason that the presence of a third person requires extra attention, which detracts from concentration on the work at hand and seriously interferes with the operator's suggestions to the patient.

Dentinal sensation is very capricious. Many cavities the preparation of which with metal instruments and especially burs causes pain can be painlessly prepared with carborundum stones run wet. Slice preparations for inlays with the use of small carborundum stones for shaping the interior of the cavities have gone a long way toward bringing about the millennium in painless inlay construction. Stones are now available in shapes and sizes for all but the smallest cavities and should be used extensively for all classes of work. No one can appreciate the increased comfort of excavation with carborundum stones over that with burs until he experiences the use of both in his own mouth. Stones cut best when run at medium or low speed and when they are kept well flooded with clean warm

water to prevent gumming of the surfaces.

Burs should always be sharp, to cut effectively; and to prevent heating, they should shave, not grind. All long handled excavators should be sharpened each time they are used. One or two strokes on a clean dry Arkansas stone is sufficient. Dull instruments require heavy pressure to force them to do their work, causing unnecessary pain and creating a tendency to skid over the surface to which they are applied.

Some dentin can be deprived of its sensitiveness by desiccation. This is best brought about by gently directing into the cavity a steady current of compressed air warmed slightly above body temperature. This will evaporate the moisture from the dentinal fibrillae, without which pain impulses cannot be conducted. Surface dryness makes it possible to excavate for a short distance until moist dentin is again encountered, when the drying operation must be repeated. Dentin can also be deprived of its normal sensibility by the destruction of the dentinal fibrillae with chemical agents. A few hours' application of arsenic, formaldehyd or zinc chlorid will devitalize the fibers for a considerable distance beneath the surface, but because its use is likely to be followed by death of the pulp on account of its penetrating to a greater depth than is anticipated, such methods have been rather universally abandoned. Phenol and silver nitrate, if sealed in cavities, will destroy the fibrillae for a shorter distance beneath the surface than will formaldehyd or zinc chlorid, and repeated applications are helpful, but their action is too slow and too unreliable for modern practice.

Dentin can also be deprived of its normal sensation by refrigeration. Lowering the temperature by means of ethyl chlorid or ether sprays will render dentin and pulps insensitive. The chilling process in itself is quite painful and, in addition, it is impossible to estimate accurately the degree of cold produced. As pulps when frozen, as occasionally happens, are almost sure to die, this method likewise has gone into the discard.

Local anesthetics, such as cocain and procain, when applied to the surface of dentin are unabsorbed and are of no anesthetic value. They are effective in dentin only when forced through the dentin and into the pulp by high pressure syringes seated in minute cavities drilled in the tooth structure; but the high pressure has caused many pulps to die.

Although many years' search has been made for an agent or method which would desensitize dentin through topical application, none has yet been found to fulfil the requirements. The most reliable means at our command is the injection of local anesthetic solutions to block the conduction of pain impulses from the area. This procedure in no wise endangers the lives of dental pulps or injures the supporting tissues.

Pulp sensation in the upper teeth can be obliterated by injecting 15 drops of a 2 per cent procain solution into the periosteum over the labial surface of the apices of the roots of the teeth. Only one injection is needed for each tooth. The site selected for the primary insertion of the needle should be immediately over the root of the tooth to be operated on and at the point of reflection of the buccal or labial tissues. In that location, there is a much poorer nerve supply than in the gingivae, and the needle can be inserted without causing much pain. Here, the tissues are loosely constructed, with large intercellular spaces allowing the diffusion of anesthetic solutions under very light pressure, there being an easy

interchange of anesthetic solution for lymph.

In introducing the needle, the operator should carry it upward and inward with the beveled side facing the periosteum until it is felt to engage in that membrane. Two or three drops of solution expelled just as soon as the needle enters will make its final seating entirely painless. One cubic centimeter deposited over each apex is ample provided it is injected into the periosteum. At the time the needle is being inserted, say, "Now you will feel this just a little"; and while the injection is being made, "There now, this is the most I am going to hurt you." While waiting for anesthesia, explain in their chronologic order the symptoms which are to follow and the patient will welcome them instead of becoming frightened when they are felt. For example, in the mandibular injection, anticipate the tingling and sensation of swelling in the lower lip, stiffness of the tongue, feeling of heaviness in the entire mandibular region and anesthesia of the face on the side injected. This will divert the patient's mind from apprehension of the operation and will arouse interest instead of dread, and he will work with the operator instead of against him.

In the lower teeth, a pterygomandibular injection of 30 drops of 2 per cent procain solution will anesthetize quite satisfactorily. This one nerve blocking injection produces within twelve minutes complete anesthesia of all pulps of the mandibular teeth on the side injected and gives a working anesthesia of about forty minutes. It is remarkable how much good work can be accomplished in that time. Anesthesia makes possible better cavity preparation, which means better dentistry; and high grade painless dentistry makes for better fees and more loyal patients.

In spite of all arguments to the contrary, local anesthetics do disturb the tissues at the site of injection. The degree of disturbance is variable. Patients should not be deceived in this matter, but it should be made clear to them at the outset that some after-soreness in the area of injection is to be expected. Most people prefer the small discomfort of a little after-soreness to the endurance of painful operations. Speed is always desirable within reasonable limits, and operations under anesthesia can be performed in much less time than without it; but, on the other hand, good dentistry demands attention to minute details, and the practice of rushing headlong through a dental operation is just as much to be deplored as undue haste in the performance of any other task.

For patients who lack the ordinary ability to control their emotions and to whom the mere vibration of a bur is interpreted as a painful or distressing sensation, local anesthesia is not indicated. Instead, an amidopyrin or a morphin-hyoscin combination should be administered. The additional administration of local anesthesia should also be employed if pain is encountered.

The rather large group of patients who belong to the worrying class frequently need general medication of a nature that will relax the nervous tension. Here, drugs which stupefy by depressing the centers of pain perception are most applicable. A typical example of this group is a combination of morphin, one-sixth grain, with hyoscin, one one-hundred-fiftieth grain. This tablet is administered by mouth one half hour before operation and will do much to obliterate mental anguish and dread. A combination of amidopyrin, 3 grains, with acetanilid compound, 3 grains, taken one

hour before operating, is less potent, but quite satisfactory for milder cases.

General anesthesia carried only to the first or analgesic stage produces a similar state, and, because of its evanescent effect, is preferred by some. When nitrous oxid is used for this purpose, oxygen is added to the amount of 20 per cent. The high oxygen percentage controls cyanosis and prevents loss of consciousness. Most patients in the analgesic stage will, in a rather inebriate manner, recognize pain sensation, but their memory is so impaired by the anesthetic that they forget about it on recovery. Needless to say, the reduction of perception which their nervous systems experience shields them from injury. The analgesic state is a wonderful boon to some patients.

All pulp extirpation should be performed under local anesthesia, which lifts it entirely out of the class of painful operations. The several injections are the same as for cavity preparation. The local anesthetic solution should be injected prior to the adjustment of the rubber dam in order that anesthesia may be complete by the time asepsis has been established and there may be no delay. In most instances, there will be a working time of at least forty minutes.

Rubber dam adjustment can be made very painful, especially to children and young adults whose teeth have not erupted enough to permit the dam readily to embrace the teeth at their gingival lines. A sufficient number of teeth should always be included in the dam to afford free access to the operative field, but the number ligated should be small. Sticky wax has replaced ligatures for retaining the dam in position almost entirely in many practices. Long application of the dam should be avoided if possible.

Dull scalers are an abomination. What has been said about sharp excavators applies equally to scalers. Select delicate scalers that cover small areas and keep razor edges on them. A sharp scaler will dislodge calculus with slight pressure and, when guided by a light grasp, will plane the surfaces of roots without producing discomfort. Dull scalers act as burnishers, and they are ineffective and pain-producers.

In this review of pain relieving measures for dental operations, I have endeavored to enumerate some common mistakes and to suggest a few devices that have proved helpful in general practice. All of them are to be used with judgment and discretion. Human understanding is a most essential attribute, without which dentistry ceases to be a joy.

The most valuable step toward painless dentistry is routine scaling and polishing of the teeth of every patient at three, four or six month intervals. The frequency of prophylactic treatment should be governed by the patient's susceptibility to caries and his tendency to accumulate calculus. Let us see how this plan works out:

Frequent polishing renders enamel surfaces less likely to accumulate mucus plaques and to become carious. The gum becomes firm and healthy because it is not irritated with products of fermentation or putrefaction. Patients become acclimated to clean mouths and do more thorough home brushing than they would do otherwise. If cavities have formed, the frequent visits permit of their early detection, and they can be filled while quite small and insensitive. Pulp involvements are thus avoided and the root canal question is solved, pyorrhea is unlikely to develop and a sense of mouth comfort, to many persons hitherto unknown, is established. Teeth in well kept mouths are relatively insensitive, and this condition,

coupled with a fine friendship and understanding built up between patient and dentist, renders the employment of anesthetics unnecessary except for such extensive work as jacket crown preparation and occasional pulp removals. Patients welcome their regular dental appointments and the control of pain in operative dentistry ceases to be a serious problem.

THE COMMITTEE ON THE STUDY OF DENTAL PRACTICE COOPERATING WITH THE COMMITTEE ON THE COSTS OF MEDICAL CARE

IN 1929, the American Dental Association granted a request that a committee be appointed to cooperate with the Committee on the Costs of Medical Care and that funds be appropriated for this purpose. The latter committee, composed of members from both professional and interested lay groups in the country, under the chairmanship of Ray Lyman Wilbur, has undertaken a comprehensive study of medical care in the United States.

Originally, the purpose of the cooperating committee (the Committee on the Study of Dental Practice) of the American Dental Association was to plan and complete a study of the economics of private dental practice, that is, capital investment, income, etc. Attendance at the meetings of the Committee on the Costs of Medical Care convinced the cooperating committee of the need for increasing its scope and activities. This need was presented before the meeting of the American Dental Association at Denver in 1930, and an appropriation of $12,000 for the making of additional studies was granted.[1]

After careful consideration of a number of proposed studies, in the light of their relative values, both to the profession and to the public, the committee agreed to limit its work for the present to the following program of research:

1. The completion of a questionnaire study of dental practice in certain selected areas in the United States. (Questionnaires for this study are now all in and are being tabulated. The study will be ready for publication in March or April, 1931.)

2. A study of experiments in supplying dental care through clinics.

3. A study of the cost of dental education to the student.

4. A study of capital investment during the first year of dental practice.

5. A study of the present results and trends of supplying medical care through the application of the principles and practice of insurance, i. e., a study of insurance as a means of paying the costs of medical care.

6. A study to develop the standards of what constitutes good dental care for an average population. (This study is being undertaken in direct cooperation with the Committee on the Costs of Medical Care and will constitute a part of a larger study intended to cover the entire field of medical care.)

1. It was found that the insurance study would cost considerably more than funds allowed by the American Dental Association would permit. Therefore, the American College of Dentistry has agreed to finance that study.

To secure a maximum value from the foregoing program, it is planned to correlate the studies whenever and wherever possible. The aim of the committee is not only to conduct these studies and present the results to the Committee on the Costs of Medical Care, but also to acquaint the profession with the objective, scope, significance and progress of each study. To the latter end, the remainder of this article will deal with the increasingly important study of insurance. Subsequent articles will be published from time to time, presenting facts relative to the other studies undertaken.

STUDY NO. 5: A STUDY OF THE PRESENT RESULTS AND TRENDS OF SUPPLYING MEDICAL CARE THROUGH THE APPLICATION OF THE PRINCIPLES AND PRACTICE OF INSURANCE

In the proposed investigation of medical insurance,[2] it was decided at the outset that to attempt the separation of the dental from the medical phases would serve no good purpose. The interests of the professions concerned are not and cannot be disassociated. Therefore, it is fundamental for the dental profession to realize that whatever happens to the medical profession is, for the dental profession, in the nature of a prediction.

The committee is fortunate in having the services of Mr. A. M. Simons for the interpretation of the data, and subsequent statements made are the direct results of his studies. Following the library study in this country, the committee plans to send its representatives to certain of the countries where medical insurance systems are in operation, for the purpose of gathering some first-hand information relative to the operation of these insurance systems.

The insurance system of supplying medical care had its inception in Germany in 1883. Although England adopted its so-called "panel" system in 1911, the movement progressed slowly until the period following the World War. Since 1919, there is to be noted a tremendous acceleration of the movement, and today compulsory medical insurance is in operation in twenty-seven countries and some form of voluntary medical insurance is to be found in fifteen countries. At present, several South American countries, Australia, South Africa and Sweden either have adopted plans for compulsory insurance or have them under favorable consideration. In Canada, British Columbia is considering a report by a royal commission recommending compulsory health insurance, and other provinces in that country are investigating the subject.

The Tenth International Labor Convention, embracing all countries adhering to the League of Nations, devoted its entire session, held at Geneva in 1927, to the subject of medical insurance. The convention was preceded by an extensive investigation of all existing systems of health insurance. At this convention, the plan of compulsory health insurance as applying to industry and commerce was adopted by a vote of ninety-seven to nine, and as applying to agriculture, by a vote of eighty-five to nine. Since this action practically binds all countries belonging to the League to install such a "system" at the earliest possible moment, it would appear that the period is very short before nearly every nation, with the exception of the United States, if that is to remain an exception, will have a system of compulsory health insurance.

2. The study of the application of the principle of insurance to medical care is a necessary preliminary to a similar study in relation to dental care.

ATTITUDE OF THE PROFESSIONS

Usually, when the agitation for medical insurance begins, organizations such as mutual aid associations and private insurance societies, are already in the field, highly developed financially and politically powerful.

The attitude of these organizations antagonizes the medical professions because, in most instances, it is not in accord with professional ideals of ethics. As a result, the professions have little influence in the preliminary transactions when laws are being formulated, and the professions are driven unwillingly, and in spite of so-called "doctors' strikes," into compliance with unsatisfactory rules, regulations, and red tape.

SITUATION IN THE UNITED STATES

Is there any reason to believe that such a world-wide movement will pass this country by? All the elements that preceded medical insurance in other countries are present here, and we have already gone a considerable distance toward health insurance in the operation of the workmen's compensation legislation. This came with the same sudden sweep that characterizes the expansion of health insurance in Europe, was subjected to the same opposition and criticisms and is steadily showing the tendency to continue the expansion which is characteristic of health insurance.

While, up to the present time, no state has adopted any health insurance law, many investigations of old age insurance, unemployment insurance and other types of insurance which have preceded health insurance in other countries are now under way. It is also well to remember that among all the ingredients that compound themselves into a prescription for health insurance, the most dynamic one, that of public dissatisfaction, is giving more and more evidence of its presence. It is a well established law of social evolution that social legislation involving state activity in behalf of the working class invariably follows periods of industrial depression.

The question has been asked, "Is dentistry at the crossroads?" The answer is obvious. Not only dentistry, but also the whole system of medical care, is, and let us hope it always has been, at the crossroads of evolutionary progress. Change is inevitable, but it is the human faculty of adaptation that may determine whether or not the change is to be controlled and gradual, or uncontrolled and explosive.

In other countries, the professions were compelled to adapt themselves to changes that were regarded as harmful. In this country, the opportunity of having a hand in determining the direction of change is still before the professions. What the professions will do with this opportunity depends entirely on their ability to make objective studies of medical problems, to reach conclusions through group judgment and, wiping out petty animosities, to take group action on the conclusions reached.

These studies are being carried out under scientific auspices. Mr. A. M. Simons, well-known economist, is conducting the library study on insurance in Europe, Study 5 listed above. Mrs. Dorothy Fahs Beck is conducting the study of dental income, Study 1 listed above. Mrs. G. J. Leuck is conducting the study on clinics and the capital investment study, Studies 2 and 4 respectively listed above. Study number 6 will be taken up sometime after January 1. Dr. Nathan Sinai, a member of the staff of the Committee on the Costs of Medical Care, has acted as adviser in the direction and development of these various

studies. The American Dental Association Committee having these studies directly in charge consists of R. E. Denny, Harold J. Leonard, Guy S. Millberry, C. E. Rudolph and Herbert E. Phillips, chairman.

RADIODONTIC INTERPRETATION PERTAINING TO OPERATIVE DIAGNOSIS*

By CLARENCE O. SIMPSON, D.D.S., St. Louis, Mo.

IN order for the various phases of operative dentistry to serve as a bulwark against the destructive processes which cause premature loss of teeth, every adjunct must be utilized. The mechanics of restorations have been perfected and standardized, although their adoption is far from universal. There is yet a great need for a keener sense of responsibility in restoring tooth form and in conservation of the gingival attachment. Too often, teeth are repaired at the expense of the periodontium, the adjacent teeth or the occlusal balance.

The general trend in the application of preventive measures is not so progressive as their conclusive value warrants. Apparently, dentistry has developed too much as a reparative and replacement service for the preventive conception to be quickly grasped. Dental technics and economics have been founded upon the policy of waiting for the damage to occur before instituting treatment. It is obligatory to revolutionize theory and practice to conserve rather than to repair and replace.

Radiodontia offers indispensable aid in raising the conception and improving the standard of operative practice, but it cannot fully function until the limitations of clinical diagnosis are recognized. While it is believed that ocular inspection and instrumental examination are adequate for the discovery of caries, the diagnosis of periodontal disturbance or determining the efficiency of restorations, and that response to vitality tests excludes pulp disease, radiodontia is being debarred from its greatest field of usefulness.

Interpretation cannot be discussed most advantageously without due consideration of the methods employed in obtaining the evidence and the character of images which are to be interpreted. In accepting the literal meaning of interpretation as reading or translating, it is necessary to have something which can be interpreted. If a radiodontic examination is not made, or if the images are imperceptible, an interpretation is impossible.

When all the factors pertaining to diagnosis and exclusion are not visible, a radiodontic examination is indicated, and this is the only safe rule for deciding whether it is needed. The decalcification of deciduous roots and the development of the permanent teeth cannot be determined except by a radiodontic examination. Incipient caries in the approximal surfaces cannot be discovered without mechanical separation or a radiodontic

*Read before the Section on Operative Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

examination. The relation of caries or cavity preparation to the pulp cannot be revealed without a radiodontic examination. The condition of the periapical structures and the comparative efficiency of canal operations are disclosed only by radiodontic examinations. The approximal contour and gingival adaptation of restorations are shown most clearly by radiodontic examinations. The destruction of the alveolar processes and the remaining bone support of teeth are most accurately determined by radiodontic examinations. All of this information is essential for diagnosis in operative dentistry.

The examinations must be made with sufficient thoroughness and skill to reveal clearly the structures which are being investigated. The evidence must be closely studied and carefully weighed in order to avoid misinterpretation and errors of judgment. Considerable experience is required for familiarity with the appearance of the normal structures and the range of anatomic variations which prevail. An important feature in interpretation is distinguishing the structural changes resulting from trauma and disuse atrophy, which often simulate pathologic processes.

If all the requirements have been fulfilled, the evidence of chronic disease is usually quite obvious. Incipient disturbances are more difficult to recognize, and study should be concentrated on them because of the favorable prognosis and value of the service. Structural changes are equal in importance with variations in density, and this especially applies to the lamina dura. Periodic examinations are most valuable for comparison in detecting the early stages of disease. All available clinical data should be correlated in forming a conclusion, but contrary to the statements of those who depreciate the service, radiodontic examinations supply 80 per cent of the evidence in establishing a diagnosis for operative procedure.

STATE DENTISTRY—WHY?*

By C. M. FINFROCK,† Cleveland, Ohio

STATE dentistry or socialized dentistry is tied up with the larger matter of state or socialized medicine. The term is unfortunate because it has two connotations. One has to do with a rather arbitrary matter of government regulation and the other is a question of public health.

The extreme view to which so many of you are opposed is illustrated by the definition of state medicine by G. W. Haigh[1]:

> State medicine is an organization based upon the economic principle of the division of labor and designed to insure co-operation in supplying a public necessity, to-wit, a complete free, in time compulsory, health and accident service maintained by each commonwealth. It would necessarily embrace the present departments of public health and of industrial accidents. It would furnish for all

*Read before the Northern Ohio Dental Association, Cleveland, Ohio, June 4, 1930.

†Professor of Law, Western Reserve University Law School.

1. Haigh, G. W.: "State Medicine, Boon or Bogey," N. Am. Rev., February, 1929, p. 193.

who accepted its benefits the same service as that provided by the medical corps of the Navy for its personnel.

One can see why there would be some trepidation on the part of the dentists if they were to become salaried officers of the state, being required to put in so many hours each day and perform a certain prescribed number of operations. If that were the aim of state dentistry as we see it approaching, I would not hesitate to advise you to fight it at any and every point.

However, that is not the trend evidenced in this country today, and it is my purpose to try to show you the exact situation and the reason for it.

There are inherent in government as we know it certain powers which one will not find in the state or national constitutions; nor are they specifically defined in any statute enacted under these constitutions, and yet it is under the authority of these powers that the greater part of all regulatory legislation is enacted. It is a fundamental concept of government as we understand it to provide for the conservation and preservation of public morals, public safety and public health, and do all things necessary for the general welfare of the people. The power to do this is called "police power." With us, not only is it inherent in government but there is also only one restriction on it, namely, that it shall be exercised in a reasonable manner, and the final judgment as to that is left for the determination of the courts. The courts have, by a long line of decisions, held that the power is plenary in the legislature, and unless there is a clear and unreasonable exercise of power in the specific instance, such legislation will be upheld.

Is it not strange that people must live by rules or laws? They have fought for rules to live by; they have declaimed against rules of their own making by which they live; they have wanted more of them; they have wanted fewer of them; they have used them for good purposes and they have used them for bad; they have praised and idealized them when they regulated the other fellow's conduct, and they have damned them when they have regulated their own conduct. Man from before conception, through conception, birth, life, death and after death has been regulated by law and, fortunately for most of us, we are usually unconscious of it all.

Really, in the last analysis, it is the people's philosophy of life which is enacted into law; not some little individual formula which may appear to the individual or the group to be the *sine qua non,* but the mores of the people developed through years of living and years of experimenting, always some moving forward, and more often some slipping back; but, in the long run, there emerges that custom or rule of action which is found to be an improvement on the past. It seems sometimes that all progress has been made through trial and error. The thing that has been sought has been usually the satisfaction of some present desire, or an attempt to reach a result hoped for as being the thing that is most to be desired. More often than not, the motive of both the individual and the group has been pure selfishness.

Owing to the efforts of dentists and doctors, through their many organizations, together with the activities of many social agencies, the people during the past quarter of a century, through clinics, schools, both public and private, and by means of good advertising and also by quack advertising, have been educated in the matter of public health. They have been led to realize that the individual's health is not a matter of private concern

but a very important matter of public concern. Sanitation, vaccination, quarantine, the regulation of drugs, narcotics and alcoholic liquors, food inspection and countless other things are now a matter of vital public concern. No private individual or private organization could do anything fundamental toward compelling action in these matters, and it was left for the state, by power of protecting the people in health, comfort and safety of their persons and property, and in the exercise of the power to look after the general welfare, to provide rules of action for all agencies and individuals in any way connected with public health.

Let me give you a little sketch of what has happened in the State of Ohio. The first statute regulating the practice of medicine was enacted at the first session of the ninth general assembly at Zanesville, Jan. 14, 1811, and is found in the Laws of Ohio, Vol. IX, page 10. The preamble to this act is interesting:

> Whereas, The practice of physic and surgery is a science so immediately interesting to society, that every encouragement to its promotion should be given, and every abuse of it, so far as possible should be suppressed, therefore . . .

This statute was tinkered with at subsequent sessions until, by 1833, there was just one statute on the books and that had to do with the taxing of physicians along with the lawyers.

Twenty years go by, and we find fourteen sections of the statutes devoted to these matters. Another quarter of a century passes and, in 1880, there were nineteen sections. By 1904, these had increased to fifty-seven, and in the present year, 1930, there are 375 sections of the statutes which have a direct reference to the practice of medicine and its allied branches. To those of you who have had some fears regarding the terms state dentistry and state medicine, I suggest that you read these statutes and you will see that state dentistry and state medicine are not something for the future; they are both here now.

What are you doing about it? Have you the same attitude that R. Thompson, president of the Ohio Medical Society, had in June, 1849? In his inaugural address he said:

> Without stopping to enquire into the right which one class of men had to care for another, or whether by proscription of the law the Legislature can proscribe one set of men and establish another in regard to a matter of science or want of it, or whether a community has a right to employ a regular physician or a quack, I may say in truth all enactments on the subject of medicine, proscriptive, prescriptive, or dictatorial under fines, penalties, or disabilities are extremely difficult of execution and hence impracticable and soon become a dead letter in the statute books.

But coming down to our own time, you have this opinion of our own Dudley P. Allen who, in his address to the Ohio Medical Society as its president, in 1893, says:

> The constant reference which in these early days was made to the regulation of the practice of medicine by law, and the evident inability to secure the ends desired, will be of interest to all of us, showing that our predecessors, no less than ourselves, were unable by any process of law to advance the practice of medicine. . . . As a society it may be of interest for us to notice that the most strenuous efforts have been made by our fathers and grandfathers to regulate by law preliminary and medical education, to establish examinations for admission to the practice of medicine, and exclude quackery. All these attempts have failed.

In the year 1930, this attitude on the part of your profession or the medical profession is merely the ostrich habit of sticking its head in the sand and thus thinking that it has secured its own safety. The whole trend in both professions must be to adopt as your slogan that private health is a matter of public concern. You must realize that we shall have more

regulatory laws rather than fewer. It must be seen that every agency in the state is pointed toward preventive medicine and preventive dentistry, that each member of the general public must, sooner or later, whether he as an individual desires it or not, submit to medical and dental service for the general welfare of the people, and the only way this can be secured is through some form of socialized medicine and dentistry.

I see no way by which this can be accomplished by private agencies for the simple reason that it will require compulsion, and no private agency has ever been given the right or power to accomplish its ends by this means. Let me quote W. H. Maxwell Telling, professor of therapeutics in the University of Leeds:

> We spend too much time, idealism and effort in remedying various forms of social evil and defect, but, like so many of my own profession, we devote these excellencies to the curing of disease *after* it has declared itself. That is too late. We should rather be content almost to let the declared defectives work themselves out, while seeking to concentrate, if not to the exclusion of purely remedial measures, at any rate mainly to the preventive work.[2]

To accomplish this end, I again suggest that it must be done through the state. These laws are not antagonistic to true personal liberty, nor must they be considered antagonistic to individualistic practice. The ends to be accomplished by regulatory laws are, in the main, these: 1. Registration of births, deaths, marriages. 2. Detection of the presence of transmissible and communicable disease. 3. Control of epidemics by domiciliary quarantine. 4. Employment of prophylactic and disinfective measures. 5. Supervision of the transportation of the sick and the dead. 6. Direction of the construction and the heating of houses. 7. Protection of water supplies. 8. Health control of the manifold occupations of the people. 9. Protection of foodstuffs, milk, beverages and drugs from adulteration and impurities. 10. Education of physicians and dentists. 11. Protection of the people from diseases from foreign countries. 12. Control of garbage, streets and sewers. 13. Hospitalization of the insane, blind and epileptic, entirely or partially on private foundation.

These are here now, and the next step will have to be compulsory health service, in order that the general health shall be conserved. This is socialized medicine. Can you fit yourselves into the picture?

I believe that you ought not only to fit yourselves into the picture, but that you should also have a hand in painting the picture. Through your organization, you should keep a committee in touch with the state department of health, and have a definite say as to what type of public health service in dentistry we should have, so that every one in the state could have the best service at a cost which he can individually bear; and to those who cannot pay, the same type of service should be given by state tax supported clinics in order that the general public welfare shall be best served.

2. Morton: Childhood Fears (preface).

PARTIAL DENTURES: INDICATIONS AND CONTRA-INDICATIONS*

By J. K. BURGESS, D.D.S., New York City

THE human dental apparatus comprises two series of units, shaped and related for their several parts in the work of food mastication, each unit with its own individual foundation established by means of the socketed relation of its root portion—roughly, two-thirds of its entire length—in the bone of the mandible and of the maxillae, respectively, with the fibrous peridental connecting membrane interposed between the root and the bone. The aggregate of these individual foundations constitutes the foundation of the masticating mechanism, furnishes the resistance to the inevitable stresses generated in its service and bears the ultimate burden of these stresses.

This is Nature's own plan and provision for this important function and service to the organism, and there can be no argument against the statement that the highest efficiency and the greatest production of service are attained in these circumstances. Once the foundation is impaired by the loss of units, one or more, the efficiency of the apparatus is reduced in a proportionate degree; and the goal of the restorationist is the reclamation of lost efficiency and the re-establishment, to the nearest degree possible to the normal, of the reduced service.

This is done, of course, through the placement, by one or another means, of artificial substitutes for the lost units of mastication upon whatever foundation is found to be available for their support in the case in hand. For this purpose, we find two basic types of foundations: that already described for the individual unit on the one hand, and, on the other hand, the basal bone of the mandible or the maxilla, as the case may be, reshaped—usually flattened or made concave mesiodistally and convex buccolingually—through Nature's resorptive physiologic processes, and covered with the protecting mucous membrane. The elevation of this ridge, its thickness buccolingually or labiolingually and the thickness and density of the mucous tissues that cover it all vary from case to case.

When all the units of a series have been lost and we find a completely edentulous ridge, there is no choice but the placement of the full artificial denture, with its base the counterpart in area and conformation of the ridge, for the mandibular, and of the ridge and the partly encircled palatal portion for the maxillary, restoration. Between these extremes of the full natural denture with its socketed bone foundation and the completely edentulous ridge, a great variety of conditions are to be encountered in the matter of the number of units lost; the locations from which they are lost; the number that remain, the locations in which they remain; the number, length

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—mesiodistally, depth—occlusocervically, and location of the edentulous spaces; their relations to each other and to the remaining units; the elevation, conformation and thickness, buccolingually or occlusolingually, of the edentulous ridge; the thickness and density of its mucous covering; the relation of the remaining units to each other and to the edentulous spaces; their conformation, dimensions, height above the gum line, depth in the supporting structures and consequent stability; stance and position in relation to the normal; deterioration or alteration and consequent degree of impairment from the normal; the condition, quantitative and qualitative, of the supporting structures about the several units and the relation of the tissues to such units; character, condition, alinement and occlusal plane outline of the occluding apparatus, and the relation of the occluding apparatus to the remaining units and to the edentulous spaces.

Every dental restoration or superstructure contrived for any edentulous space, short of that for the completely edentulous ridge, is obviously a partial denture.

There are two basic types of such superstructures, corresponding to the two basic types of supporting foundations already described; and the manner of their construction and relation to the foundation determines their character. That supported by the membrane-covered ridge of the mandible and the maxillae, respectively, comprising a base—usually of vulcanite or metal—and necessarily removable, upon which are imposed the artificial units, is called, for want of a more accurate descriptive term, a partial plate. That supported by the natural units in their socketed foundations, comprising a span portion to which is united one or another type of attachment designed to secure the span to the supporting abutment teeth, is called a bridge. The latter type is subdivided into two classes according to methods of construction and relation to the foundation units: the fixed bridge, in the case of which the superstructure is luted by means of its attachments in a stationary relation to its supporting units, and the removable bridge, where, through the use of anchoring attachments contrived for the purpose, the patient may remove the bridge for scraping, polishing or other repairs.

In the class of removable bridgework, we find a great variety of attaching devices and many plans of construction, but, since the basic idea in all of them is removability, there is no occasion here for a discussion of their relative merits; nor, indeed, of relative values as between fixed bridgework and removable bridgework, since both are imposed upon the same basic type of foundation; and any foundation to which should be entrusted a removable superstructure of the true bridge type will support equally well a bridge of the fixed class. The choice between these two classes of the true bridge type of superstructure is not so much, therefore, a matter of opportunity as of preference, of prejudice and predilection, and must always remain a personal matter and, as far as ultimate results in the production of service are concerned, a negligible one.

Since our efforts are concerned so largely with the production of service, and since the measure of service that we can produce is determined by the foundation which supports its producing apparatus and bears its ultimate burdens, our consideration of indications and contraindications must have to do with ways and means for the utilization of any given foundation to the greatest possible advantage from this point of view. In this discussion, reference is had, not

necessarily to the foundation as presented, but to the foundation in its state of finality as brought about through whatever procedures are necessary to that end. In the matter of diseased conditions related to the teeth, internal or external, periapical or pericervical, there can be no reasonable argument on one point: the pathosis must be eradicated, through corrective measures, if possible, or tooth removal, if necessary.

As pertaining to security of anchorage in the foundation, such units as have lost their foundation support or changed their relation to it in a degree that renders them incapable of producing a reasonable, if not normal, service for lack of resistance in their impaired foundations or because of abnormal relations to them, should, if they cannot be stabilized for service and brought to the status of assets rather than liabilities, be removed. Teeth split through their long axes or showing cross fractures of their roots are always doubtful, and generally negative, factors in any foundation; and those with diagonal fractures involving the root to such depth that, on removal of the fragment, it is found impossible or impracticable to make accurate adjustment of an attachment to the remaining portion, as well as those roots whose crowns have been lost through decay or other circumstance, presenting the same difficulties or obstacles, must, of course, be removed. The tilted tooth frequently presents a problem and its angle of decline taken in connection with other factors of the case must determine its retention or removal.

Thus, it must be seen that all matters, pathologic, physical, mechanical and relational, pertaining to the separate units, to their surroundings and to the occluding apparatus must be taken into consideration and acted on. When these procedures are completed and the foundation brought thus to a state of finality, and not until then, are we in a position to estimate its value as a whole and that of its several units and sections. We can then determine all matters pertaining to stability and strength, the measure of support and resistance reasonably to be expected of the section or several sections under consideration, or of its entirety, under either of the basic types of superstructures, where a choice is possible, and place that type or those types, singly or in combination, that will achieve the end toward which we are directing all our means: the production of the greatest measure of service capable to any given foundation.

With these fundamental facts established as a basis of our further considerations, we come finally to the direct matter of indications and contraindications. In certain conditions and relations, there is no choice but the ridge supported partial plate; for example, the edentulous space in the molar and bicuspid regions with no tooth distad from it or with one so posed and related that its use for bridge anchorage purposes is plainly out of the question; also the anterior space where as many as the six anterior teeth have been lost, and in most cases where five consecutive anterior teeth, cuspid to lateral incisor inclusive, are missing. The same thing is true when the edentulous space is centered, or nearly so, at the cuspid angle, which divides the anterior from the posterior teeth, and runs the mesiodistal width of any considerable number of teeth in either or both directions from it. In these anterior and angular locations, there may be modifying circumstances that will mitigate the strictures against using the tooth type rather than the ridge type of foundation. These will be spoken of later.

Eliminating these impossible and doubtful conditions as, unquestionably, contraindications for any type of tooth-supported superstructure and, as a consequence, definite indications for the ridge supported partial plate, we come to conditions and relations where there is opportunity for a choice between the two basic types of foundation, and so between the types of superstructure by means of which to replace the lost units.

Reference is had here to the edentulous space, in whatever section of the arch, with one or more units at either end of unquestioned security and strength, and consequent ability to support a superstructure imposed upon them. It is here that prejudice and predilection so frequently warp the judgment, take precedence over scientific considerations and dominate the situation.

In an article entitled "Planning the Restoration," published in the current issue of the *Dental Cosmos,* it has been my privilege to establish, to my own satisfaction at least, the thesis that the socketed unit type of foundation, where available, furnishes a greater measure of resistance to the stresses generated in mastication and constitutes, therefore, a supporting medium far superior to the membrane-covered ridge. Since service is the desideratum, and since a normal measure of service can never reasonably be expected from any impaired foundation, the nearer we can approach such normality, the better the foundation is made to serve its purpose in supplying the needs and fulfilling the demands of the organism.

These, it would seem, are biologic and scientific considerations which should outweigh the petty prejudices that sway the minds of so many operators toward this or that point, which, in the light of the higher purposes of the denture, are shown to be of minor importance. It is trite to say that no method or procedure or combination of them can achieve every advantage to be desired. This being true, it would seem wise to center attention and effort on the paramount issue of service and its production in the greatest measure possible in the circumstances of any given case.

With this basic idea as the determining factor, I consider all such foundations, with few exceptions, as indications for superstructures of the tooth-supported or bridge type and, therefore, as contraindications for the partial plate. But here again arises a difference of opinion even among those who are agreed on the general proposition of the superiority of the bridge type of restoration as compared with the partial plate. Many operators advocate, in theory at least, replacing not more than two consecutive teeth by means of the bridge type of restoration. Such operators, if my observation is not at fault, usually limit their foundations to a single abutment tooth at either end of the space; and so long as these men will so circumscribe the foundation, their niggardly limits on the length of the bridge span is perhaps consistent and wise. But both ideas display an unpraiseworthy timidity and lack the bolder stroke that makes for a larger measure of service and the greater blessing to both patient and operator.

The construction of the dental bridge is basically just as surely an engineering problem as is the construction of the railroad bridge or the traffic bridge. The wise engineer provides a foundation that will meet the service requirements of the superstructure it is designed to support. By the same token, there is no reason that the dental restorationist may not and should not amplify his foundation and greatly increase its supporting and

resisting power by the inclusion of one or more additional units, where available, at one or both ends of the space.

With this common sense provision for its support, the longer span, where conditions for its use exist, is practicable and serviceable. In truth, the shorter span is frequently inadequately supported with a single abutment at either end and I have long made it a practice in cases where the second bicuspid is the primary mesial abutment to give it the supplemental aid of the first bicuspid, or if the first bicuspid bounds the open space, to add the cuspid; and so on, around the arch. Posteriorly, when two molars remain, I rarely leave the distal one out of the foundation. The margin of strength and resistance secured through these procedures supplies, in many cases, the difference between weakness and power, between frailty and durability, between failure and success.

The tragedy of denture reorganization as so frequently practiced is the unused foundation.

In our considerations thus far, we have had in mind the single edentulous space confined, for the most part, to one section of the arch. With increase in the number of spaces and the sections they occupy we encounter greater prejudice and sterner objections to the tooth-supported bridge type of restoration, especially the fixed bridge, the most persistent claim, perhaps, being that teeth in different sections of the arch have their greatest range of movement in different axes and should not, therefore, be joined in a fixed relation.

Here, again, is a weakness in engineering perception. If it is true that the molars and bicuspids move more freely in the buccolingual direction and that the anterior teeth are better stabilized against movement in this direction, it should be apparent to the most casual engineering sense that teeth in these circumstances, when united, afford each the other, in a measure commensurate with its own stability of anchorage, resistance against a range of movement under the excursive drive of the mandible that, but for such aid, might prove distressing.

There is provided, in this situation, some compensation to the remaining units for the lost support which, in normal circumstances, the units afford each other through proximal contact. Where the edentulous spaces and the remaining units and their relation to each other make it possible, these conditions and relations are always indications to me for the long bridge, and particularly the full bridge, especially because of the invaluable reciprocal stabilizing power which each section affords to every other section and the consequent increase in resistance and its greater aid to service established in the foundation as a whole.

It must be remembered that only one section of the denture is in the active service of mastication at any given time and that, in the case of the full bridge, its entire foundation throughout the length of the arch from molar to molar furnishes its entire support and resistance in aid of that one section against the stresses exerted in the buccolingual direction through the excursive movements of the mandible which produce the severest strain against the foundation structures and constitute their greatest menace.

What is true of the full bridge in these respects is true in a proportionate degree of any bridge extended in length to occupy two or more sections of the arch. Because of these advantages of mutual sectional support, spans of such length in any section or those bearing such relation to the cuspid angle, as would make their use impracticable for single edentulous

spaces, are, in many cases, not only justifiable, but also the choice of the evils that confront us, and their construction as integral parts of the long bridge, especially the full arch bridge, is a proper engineering procedure.

Throughout this presentation, I have had in mind the full natural denture, normally anchored and normally related, as the occluding apparatus in relation to which we have planned our superstructure. Such a normal, occluding denture produces the greatest measure of service, generates the highest degree of stress, delivers the heaviest burden and exacts the severest penalties against the subnormal foundation which is our field of operation. As we move from case to case and find our occluding apparatus receding in constantly increasing degree from this normal—such conditions and relations as the natural denture with subnormal anchorage, in subnormal occlusion or out of occlusion; the artificial partial restoration of the tooth-supported type, or the ridge-supported type; the full artificial ridge-supported denture; the edentulous space to be left vacant, and certain variations and combinations of these—we find the influences operative against our restorative efforts correspondingly mitigated and, in the altered circumstances, justification for a freedom of action in plan and procedure—the longer span and the bolder stroker—denied to us in the more exacting circumstances of the occluding normal natural denture.

I have tried to present these matters from the purely scientific point of view, unbiased by any considerations other than serving the highest interests of the organism through the production from any given foundation of the greatest measure of service to the organism. I am aware that there are many circumstances that must influence our decisions and alter our cases: sex, age, social standing, habits, health, financial inability, the time factor and many other matters, including personal preference on the part of the patient. But we must first understand and be able to achieve the highest possibilities of the case and be dissuaded to the lesser substitute only through force of the untoward circumstance.

I hope I have not left any doubt as to my own preference for the tooth supported bridge type of superstructure as against the partial plate; and for the fixed bridge rather than the removable bridge. I consider the several sections of the arch —the right posterior, the anterior and the left posterior—separately and carry my preference to the point, where two or more sections are involved, of bridging the section or sections whose foundations will admit of it and supplying the partial denture only for the section or sections where the foundation for the bridge type is not available. By this means, I make the effort to produce the greatest measure of service capable to the foundation of each section, individually, and, as a consequence, raise the standard of efficiency of the denture as a whole.

THE MAXILLARY SINUS*

By WILLIAM L. SHEARER, A.B., M.D., D.D.S., F.A.C.S., F.A.C.D., Omaha, Nebr.

IT it well known that the maxillary sinus is very important from the point of view of the dentist or oral surgeon who is making operations on the teeth and jaws the type of which may be associated with this sinus. I have long realized that there should be a much closer association of the oral surgeon and the rhinologist in combating infections of the maxillary sinus.

In 1905, I devised an operation known as alveolectomy. Its original purpose was to prepare the mouth for more satisfactory dentures, for I was constantly seeing patients who had difficulty in wearing plates after the simple extraction of teeth, owing to jagged edges of bone, too much prominence in places, etc. Later, stimulated by the desire of medical men for the complete eradication of oral disease in focal infection cases, I realized that this operation promised to meet the requirements, and a technic, including partial and complete alveolectomy, was perfected.

In a word, the operation of alveolectomy consists of a reflection of the mucoperiosteum on the buccal side up to and above the root ends of the teeth and on the lingual side about one-eighth to one-quarter inch. After the extraction of the teeth and removal of the pathologic areas, the remaining jagged edges of bone, on both the lingual and the buccal sides, are trimmed, and the mucoperiosteal flaps are returned to position and sutured with horsehair.

This procedure, with its complete exposure of root-end disease, permits visualization of the pathologic processes. It is common knowledge that the apices of the first and second bicuspids, and the first, second and third molars are in close proximity to the floor of the maxillary sinus. Dentists have long known that these teeth are just as subject to apical infection as are those in any other part of the mouth. It has been my experience to see, in many instances, not only infection of a normal maxillary sinus, but even the loss of a tooth in the antrum from attempted removal of these teeth by simple extraction and blind curettement.

Statistics are at variance as to the primary cause of certain types of maxillary sinus infection, that is, as to whether such infections are of dental or of nasal origin. I have heard it stated by men in various sections of the country that fully 75 per cent of such cases are of dental origin. From observation extending over a period of years, and including cases referred after extraction, in many of which I had the opportunity to perform an alveolectomy, when a good history could be given, it was learned that the mucous membrane of the maxillary sinus was punctured, and thereby infected, at the time of the removal of the teeth. I am convinced that the number of cases primarily infected by diseased teeth is

*Read before the American Society of Oral Surgeons and Exodontists, Evergreen, Colo., July 18, 1930.

comparatively small, and the foregoing figure is erroneous, owing to the fact that the signs and symptoms of maxillary sinus disease are often associated with or follow the removal of infected teeth. This statement is supported by the fact that, during the course of an alveolectomy, it is often possible to remove the bony floor of the sinus and find a healthy mucous membrane, and if this is left undisturbed, complete subsidence of all symptoms pertaining to maxillary sinus infection will result. I believe, from my own experience plus consultation with my colleagues pertaining to infections of the maxillary sinus, that the majority of the so-called infections of sinuses of dental origin are produced by the members of our profession at the time the teeth are removed. If this statement is true, and I believe that it is, it becomes the duty of such a body of men as are represented here to see to it that cases of infection of the maxillary sinuses arising at the time of operation be at least lessened in number. I believe now as I have always believed that progress is made when the direct responsibility of successful work is given to us face to face. Our problems and duty then must be to so work and cooperate with one another that the end-result will mean a betterment for our patients, which, in turn, only naturally will result in honor to us as a profession.

It is not my purpose to discuss with you all the various operations designed for draining the chronically infected maxillary sinus, and yet, in the course of a day's work, one not infrequently sees patients in whom a healthy tooth has been injured or the terminal branches of the infra-orbital nerve unnecessarily severed when certain accepted procedures have been followed by the rhinologist in order to establish drainage by the oral or the nasal route. With full knowledge and appreciation of the fact that the dentist is just as unprepared to operate through the nose as is the average rhinologist to operate on the teeth and jaws, I am making a plea for closer cooperation between the oral surgeon and the rhinologist. In no sense do I propose drainage through the mouth in all cases of maxillary sinus infection; for, in my early experience, I had the misfortune to attempt relief by an approach through the mouth with postoperative mouth irrigation alone of the sinus, only to aggravate the condition.

Bearing in mind the fact that in cases in which the sinus infection is due to root-end disease (which can be definitely proved by proper roentgen-ray examination), there is a chronic osteomyelitis of the jaw bone involving the floor of the maxillary sinus and often accompanied by polypi and free pus. It seems reasonable to presume that the best management of such cases would be a combined operation through the nose and the mouth. Strange as this may seem, it is not a common practice, but, in a few quarters where oral surgeons and rhinologists cooperate, excellent results have been obtained.

The most satisfactory results are obtained by first making an opening through the outer wall of the nose under the turbinate bones of sufficient size to permit proper postoperative irrigation of the cavity. (I make the nasal opening in the maxillary sinus last.) When this is done, a partial alveolectomy should be done, removing the diseased tissue at the root ends of the teeth involved in contiguous infected bone areas. When a mucoperiosteal flap is reflected from the cemento-enamel junction of the teeth, the terminal branches of the infra-orbital nerve are not severed (which produces a numbness for some time and is a source of some complaint). One can then see

the field of operation perfectly and avoid destruction of adjoining teeth.

No matter what procedure is followed in the mouth, the disease in the floor of the maxillary sinus, produced by necrosis and invasion of the sinus by infection from root ends, must be eliminated. In other words, the point of invasion is at the root ends of certain teeth in proximity to the sinus. Therefore, the disease of the bone and alveolar process in contact with the mucous membrane of the maxillary sinus must be removed, and this then becomes the proper point of attack. The larger opening in the sinus should be made in the canine fossa to visualize the whole sinus cavity and properly attend to it. When this has been thoroughly accomplished, the mucoperiosteal flap should be returned and the wound closed completely. Subsequent treatment should be completed by the nasal route.

The technical steps of this operation cannot be perfectly outlined in a paper. It can be demonstrated perfectly only in an operating room, where all surgery should be learned.

DISCUSSION

Theodor Blum, New York City: I am of a different opinion as far as nasal and throat operations are concerned, as to their being performed by men who are not nose and throat specialists. Of course, the degree itself makes no difference. There are many men who are excellent oral surgeons and do not have a medical degree. I feel that the dentist has no right to perform nasal operations. Surgeons do not perform nasal operations. If I need the nose and throat specialist, I call for his cooperation, and in New York we get cooperation. I join Dr. Shearer's doubts in the possibility of epithelium being re-formed after it has been entirely lost. I always look back to one man, Hajek, of Vienna, who says that he has never seen an antrum membrane so badly destroyed that he could not leave an island of mucous membrane covered with epithelium, and the wall probably re-covered with epithelium. I feel that if there should be regeneration of epithelium, it also would function. I also agree that if you separate a free gingiva from the periodontal attachment and replace that flap, it will be renewed. Many of my incisions are carried out in that fashion. Referring to the type of disease of which Dr. Shearer has spoken and which he treats with a certain operation: I do not believe that any opening has to be made in the nasal wall; in other words, no opening has to be made in the lateral wall of the nose, which is also the mesial wall of the antrum, in order to cure such cases; and I can only refer to my cases as he does to his.[1]

George M. Boehler, Omaha, Nebr.: If you have had a maxillary sinus operation, as I have, you will begin to appreciate the sensitiveness of the tissues in the sinuses and the blood and nerve supply and anatomic relation of the muscles there. Dr. Shearer's operation, to my mind, is the one that meets all of those requirements. The blood and nerve supply is not interfered with, the openings are no larger than is required and the results, I know, are satisfactory, because I have had an opportunity to watch them for a number of years. Dr. Shearer does not have that ruthless manner of attacking the sinus from all angles, from any sort of opening with all kinds of instruments, and tearing out whatever he finds within the antrum cavity. He removes the débris with less trauma and less destruction of the delicate membrane within the sinus and lets Nature do some of its own work, which it has to do anyway.

M. F. Wielage, Miami, Fla.: It was very interesting to see this new operation of Dr. Shearer's. I had the good fortune to see a similar operation performed by Dr. de Groot in Holland, two years ago. There is a condition in the antrum which is abnormal to start with. The ostium maxillare is in the proper place for quadrupeds, not for bipeds. There are so many abnormal conditions at the present time in the nasal cavity that proper aeration of the antrum is interfered with. Regarding the question of osteomyelitis: Whether there is osteomyelitis in that area or not, I believe that if we follow the histologic and pathologic findings, and reason properly, we will find a degree of chronic osteomyelitis in

1. Blum, Theodor: Oral Surgery of Interest to the Rhinologist, Internat. J. Orthodon., to be published.

all pulpless tooth areas. We are so limited in our vision that we should never depend on our eyesight to see whether there is osteomyelitis present or not. If that area is removed, and if we can assist Nature and cut the opening into the nose, we do something that Nature cannot perform without us. If we establish a larger opening at the bottom of the nasal wall of that antrum and leave the other opening alone, we will give proper aeration to the antrum, and will assist in the recovery of the antrum, which will not take place if we place the suture here. Do not make an opening into the antrum which does not permit proper aeration. The membrane will grow back. The body is a compensating mechanism and will restore a membrane in that antrum which is satisfactory for keeping infection away from it, much better than we will ever be able to do.

Roy S. Hopkinson, Milwaukee, Wis.: About fifteen years ago, while on a vacation, I developed a tremendous amount of pain on the left side of the jaw. Two infected teeth were removed, a violent hemorrhage following. Subsequently, it was determined that I had chronic maxillary sinusitis. In a period of four weeks, I lost 40 pounds. One of the first mechanisms of the body to be affected is the nervous system. I feel that the preoperative multiple operations that were done by men in allied professions, four in number, could have been eliminated had I, as well as the men who attended me, had the personal knowledge to investigate the contiguous tissues around the maxillary sinus. About four years ago, while at the Mayo Clinic, I asked one of the men in the department of laryngology to examine my nose and sinus, and his comment was: "You have been oversurgeryized and at the present time there really isn't anything you can do." Having had that experience, I am giving it to you for what it is worth, because I feel that Dr. Shearer, at least, whether he is right or wrong, is sincere. Knowing that, if he has a type of operation that gives results and gives the patient relief, it does not make much difference whether we agree with him or not.

Dr. Shearer (closing): So many patients were coming to me complaining of the old types of operations, particularly the Denker incision, and because of these many complaints and the unhappiness which attended my own work, I finally designed this operation. We all know quite well that the manner of attack of a problem is probably most important. When the teeth are all in the mouth, the flap is made about one-eighth inch from the cemento-enamel junction of the teeth, the incision being carried forward to somewhere near the region of the cuspid, lateral or central, and backward over the tuberosity. This makes a long flap, made without severing the terminal branches of the nerves, veins and arteries, and not associated with cicatricial contraction; nor is it attended by the other postoperative pain and trouble, such as attend all other incisions. Briefly, when the flap is laid back, one can make the opening in the canine fossa the size he wishes. If the membrane of the sinus is not to be removed, I clean the entire sinus with gauze sponges, with selvage edge turned in, after ringing each sponge out of hot salt water. In this way, the insult from instruments on the membrane is avoided. When the sinus is perfectly clean, we make an opening from the nose into the maxillary sinus just under the turbinate. The bony arch of the opening is smoothed perfectly and the mucous membrane on the sinus side and the schneiderian membrane on the nose side is picked up with a hemostat and excised to the bony edges of the opening. This is done with a sharp knife. I use iodoform gauze saturated in pure, sterilized olive oil to lightly pack the sinus. The end of the gauze is carried out through the nasal opening and the flap in the mouth is closed tightly. All subsequent treatment is carried on through the nose. If this type of operation is carried through properly, one can teach the patient in one or two treatments to take care of the majority of treatments himself. One can modify the flap to suit the case, whether it means the loss of one or of more teeth.

FAIR PLAY*

By WILMER SOUDER, Washington, D.C.

THE references which I gave, crediting the discovery of the expansion technic to Dr. Van Horn[1] antedate my critic's date of *Dental Cosmos,* June, 1912. May I quote from a further reference:

> The first attempt to compensate for the shrinkage of gold was made in 1910. Dr. Van Horn wrote a paper advising the use of heat to expand the wax model to compensate for the contraction of the gold as it passed from the molten to the solid state. . . . About a year later, without any knowledge of the experiments of others I made a thermostatically controlled investment mixer in which I mixed my investment at 115 degrees Fahrenheit.[2]

I offer no objection to my critic's claim for the original discovery. I hope that proper steps will be taken, if necessary, to establish priority and proper credit if the foregoing references are not sufficient.

It is inconceivable that one who has read the Bureau of Standards Scientific Paper No. 32 (on dental research to 1928) could raise any question regarding priority on measuring the shrinkage of gold, for therein credit is given to Weston A. Price for original, classical work on this subject.

Item two refers to discussions of certain technics and says: "We have cast full mouth bridges [by using steam elimination] that could be seated on as high as seven abutments without retouching. Has the man who sets out to reflect on us accomplished as much?"

If the question is modified to read: Has the man accomplished as much? I answer promptly, no. I regret to see mention of a commercial article (steam eliminator) injected in this plea for fair play.

The next paragraph asks a direct question: "Is Dr. Souder so interested in certain so-called legitimate manufacturers that he can call those who infringe on their business parasites?"

No; I have no financial interest in any manufacturing company, supply house or manufactured article used by the dental profession. I am intensely interested professionally and by reason of my official relations with the research program of the American Dental Association in seeing that safe materials are always available and properly used.

The paragraph closes as follows: "Is there one sentence in his whole discussion which we can take home with us and make use of in our practice? If there is, I fail to find it."

I am indeed sorry that such is the case and accept this as an honest and valuable criticism.

The next question: "What right has he to slur members of the profession who are honestly striving to improve dentistry?"

* This article is a reply to "A Plea for Fair Play," by F. S. Meyer, appearing in the December, 1930, issue.

1. Van Horn, C. S.: Dent. Cosmos, 52:877 (Aug.) 1910; 53:1113 (Oct.) 1911.

2. Meyer, F. S.: Dent. Survey, 5:77 (Sept.) 1929.

None, and no slur was intended. My sincere apology is offered if "any member of the profession honestly striving to improve dentistry" feels that he or she was slurred.

The last paragraph refers to a proposed specification for dental investment, and more specifically to the rate of mixing investments for testing.

Two opportunities were available to this critic (one through the manufacturer supplying his investments and steam eliminator and one after the publication of the proposed specification) for a direct and friendly reply to improve the specification. No reply mentioning rate of mixing was received from either.

A number of replies were received from members of the profession and manufacturers interested in establishing standards of quality for investments. As a result of this friendly cooperation, the possible differences which might occur between overenergetic and ultraconservative rates of mixing investments were precluded in the later draft of the specification as it appears in this same issue of this Journal (December, 1930, p. 2284).

TWO INTERESTING DENTAL ANOMALIES

By E. A. THOMAS, D.D.S., Hastings, Nebr.

CASE 1.—Mrs. R. W., aged 24, several years previously had had the first and second right lower molars extracted. A root of the second was broken off and was left in. Some time afterwards, it worked upward and became troublesome, and the patient went to her dentist, Dr. Cullen, of Kearney, Nebr., to have it removed. He found it retained in soft tissue and, on removal, a large cyst was revealed beneath.

The patient was referred to me and the roentgen rays revealed a large cyst involving all the maxilla from the second bicuspid to the inferior dental foramen. In the floor of the cyst was the third molar, sitting in the lower border of the cortical plate, with an almost complete pathologic fracture of the mandible.

Fig. 1 (Case 1).—Jaw of patient, showing the extent of cyst.

Fig. 2 (Case 1).—Extent of fracture.

Within the cyst was found three fibromas, the largest, about the size of the end of an ordinary thumb, located in the retromolar triangle; the second, about midway of the body of the mandible on the labial aspect where the cyst had first penetrated the outer plate, and the third likewise in the buccal plate. These two were about the size of the end of the patient's little finger.

There was a pathologic fracture of all the bone except the lower cortical plate as shown in Figure 2, and the cyst had extended through the lingual plate under the tongue, almost to the width and length of the cyst in the body of the mandible.

Fig. 3 (Case 1).—The tooth.

Fig. 4 (Case 1).—Appearance four months after removal.

The treatment consisted of removal of the cyst and its contents as well as the tooth; which it was very difficult to do without fracturing the mandible. The area was loosely packed and treated twice daily and the patient not allowed to use the jaw until it was well healed. Recovery was uneventful and satisfactory.

CASE 2.—Mr. H. K., aged 40, when seen by his dentist, George Hansen, Hastings, Nebr., had a large swelling in the region of the lower left bicuspids. The second deciduous molar was found to be still in place. The second bicuspid was missing. The deciduous tooth was removed and drainage thus established, but the swelling failed to clear up, and one morning the patient discovered that sensation was absent in that side of the chin.

The patient was referred to me, and the roentgen rays revealed the second bicuspid in the extreme lower and lingual aspect of the jaw, lying almost parallel with the lower

Fig. 5 (Case 2).—Bicuspid with calculus.

portion of the mandible. On the crown was a large amount of calculus. There was a pathologic fracture of the mandible and evidence of osteomyelitis. The bony plate around the dental foramen had become exfoliated.

Careful removal of all exfoliated bone and the tooth, which established good drainage, and immobilizing of the mandible brought results after three months.

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Editorials

ADDITION TO THE RELIEF FUND

The returns from the Christmas Seals are watched each year with ever-increasing interest on account of the greater demands for relief and the consequent necessity for building the fund to an amount adequate to care for all of the worthy cases.

It was felt that this year there might be a slight falling off due to the financial depression, but, contrary to expectations, the returns up to December 31 ran more than two thousand dollars over any previous year; and for the benefit of those who have been careless or neglectful up to this time and have not sent their check, we may say that it is not yet too late to forward their remittance.

Up to December 31, the amount received for the year was $14,561.56, which, though appreciably exceeding previous years, was far behind what it should have been. It really means that fewer than one-half of our members, on this the highest year, have contributed even a single dollar each to a cause that stands

out as the most insistent of all our obligations. If there is anything more insistent than the duty of taking care of our needy members in their declining years, or in their years of adversity, we do not know what it is. How will any man feel if, in the future, he finds himself obliged to accept aid from the Association, and has to face the fact that he failed to contribute even one dollar to building the fund? This very thing has already happened, but owing to the broad-mindedness and magnanimity of those who are administering the fund, no bona fide member of the Association has been refused aid on that account.

And in this connection, the chief reason for the increase in returns this year is largely the almost superhuman efforts of the Relief Committee during the seals campaign. As one of them stated it, the members of the committee had spent more time and energy than would be necessary to earn the entire amount received if it had been devoted to their own private affairs. The rank and file of our membership have not the slightest conception of the tedious hours of application to this and other interests of the Association on the part of the officers and committeemen, who receive no reward whatsoever except the satisfaction of aiding in what they deem to be a most worthy enterprise. About the only reaction that they ever get from their gratuitous service is the perennial criticism that usually crops up because they failed to do a better job.

The fact that this is largely true in every organization does not absolve the general membership of our own Association from the duty of considering what is due the men who are serving them, and what is due to the whole organization in the support of such worthy enterprises as the relief of aged and needy members. It would be a proud moment for the whole Association if an amount could be raised that would ensure for all time a reasonable protection against penury and want on the part of every one of its helpless and needy members.

ODORS IN A DENTAL OFFICE

There was a time when it seemed a necessary concomitant of conducting a dental office to generate an appreciable variety of disagreeable odors within its four walls. Some of these smells were typical and all of them were objectionable. The old time office reeked with stale creosote, vulcanizing rubber and other pungent odors, and the patient on ascending the stairs was met half way by unmistakable evidence that some vile drug had been spilled and the place saturated with it.

It seemed to be the theory that in order to treat and fill teeth and insert artificial dentures there must of necessity be generated foul smells that reeked to heaven, and the odor of the dental office became almost a byword in the land. Fortunately, conditions are not so bad as formerly, but to prove that there is still need of reform, we hereby reproduce verbatim a comment written by a school child in one of our states and forwarded by the dental health worker in that state:

SMELL

What does smell more disagreeable than a Dentist, with all of his things. When he walks into a room he smell like I do not know what. He will get the room to smelling like a dentist if he stays in the room very long. His clothes smell like dentistry. If you go down to his office and stay long enough you will nearly sufercate for fresh air. When he comes into the house, whether you know who it is or not know who it is, you will soon find out, for he gets the smell all over the house. The books and other things he handle or have smell like a dentist. The towel smell like him also, if he wipe on them. That is why I would not like to study dentistry.

We are tempted to remark: "Out of the mouths of babes," etc. It is high time that the members of our profession roused themselves and did away with implications such as came from that child. There is no excuse in the least for the permeation of dental offices with disagreeable odors. We may be obliged at times to use remedies that do not have a pleasant smell, but they can be confined to the case in hand and not be spilled all over the office or on the person of the practitioner.

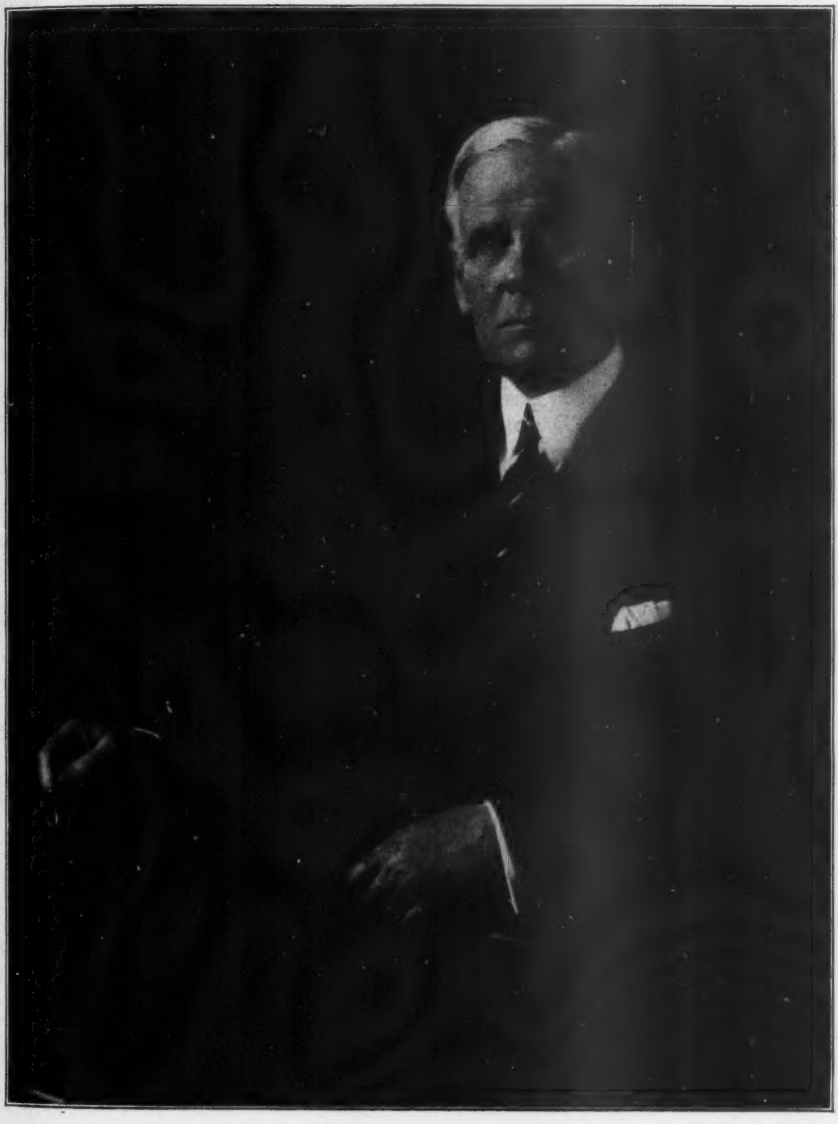
And there are many substitutes in the pharmacopeia for our evil-smelling drugs that will do the work just as effectually and with less obtrusiveness. The odor of lysol, for instance, is very objectionable to most people and it permeates a whole office. For the sterilization of instruments, other means may be used that are practically odorless, and fully as effective. Let us not advertise our calling in this disagreeable way.

How pleasant and wholesome it is to step into an office where care is given not only to the appearance of things but also to the elimination of everything disagreeable; where, in addition to the most scrupulous cleanliness, there is nothing suggestive of hospitals or surgical operating rooms! The sensibilities of most people are developed today to a point where they are attracted or repelled by the impressions made on them when they enter a professional office, and the dentist owes it to himself and his patients to eliminate as far as possible all the disagreeable features of his environment. No longer should he lay himself open to the indictment written by that school child.

STAND PAT

If you know you are right, stand pat. No matter what the clamor of the crowd may be, no matter how unpopular you are, stand your ground if you know that you are right. Always, first, be sure of your contention, and then let the whole world wag as it will, but stand pat. Preserve the sovereignty of your own soul even though the heavens fall—they won't fall very far, not far enough to hurt.

The namby-pamby, noncommittal man may step through the world very smoothly and comfortably, but he never works any great reform and never accomplishes anything really worth while for the benefit of his fellowmen. The disturber of the peace when that peace has become pernicious may be the greatest benefactor of his race; while the neutral, negative and noncommittal man may be a menace to society.



THOMAS J. BARRETT, D.D.S., A.M., LL.D.
(1865-1930)

Be cautious about acquiring a conviction. Weigh all the evidence, both seen and unseen, and then when your conviction is formed—stand pat.

THOMAS J. BARRETT, D.D.S., A.M., LL.D.

(1865-1930)

Dr. Barrett was born Nov. 15, 1865, and died of cerebral hemorrhage, Dec. 29, 1930. He was graduated from the Dental Department of the University of Pennsylvania in 1885, and began practice in Worcester, Mass., where he had lived from infancy. He at once took a leading position in his profession. He was a member of the state board of dental examiners for thirty-five years. He had been a member for fourteen years of the Dental Educational Council of America and was president when he died. He had also been president of the National Board of Dental Examiners, and of the Northeastern Dental Association. He was a member of the American Academy of Dental Surgery and the American Dental Association and was a Fellow of the American College of Dentists.

Outside his profession, he held many leading positions. He was alderman of Worcester for two years, was vice-president of the Bay State Savings Bank, and was vice-president and director of the Worcester County National Bank. He was president and member of the Board of Directors of the Worcester Public Library, and trustee and member of the Executive Committee of St. Vincent's Hospital. He was president of the Washington Club and charter member of the Elks and Knights of Columbus. He attended St. Paul's Church.

In 1918, Holy Cross College conferred the degree of A.M. on him, and, in 1926, he was given a LL.D. degree by Loyola University. He was a member of the Worcester County Club, the University Club, the Economic Club, and of the Clover and University Clubs of Boston. He was a member of the Jefferson Society of Massachusetts, and president of the Worcester City Government Alumni.

Dr. Barrett was married in 1900. His wife died twenty years ago. He is survived by two sisters, one son, three daughters and three grandchildren.

These brief chronicles will go to show the outstanding place that Dr. Barrett had reached in the professional, the social, and the business world; but they do not tell the whole story of his marvelous hold on the affections of his fellowmen. He was tall and commanding in appearance, striking in features, affable in demeanor and charming in his friendliness. He was loyal to the core to all of those who had gained his confidence, and no one ever doubted on which side of a question Dr. Barrett stood. He was true to his convictions at all times, and while he tempered his attitude with tolerance, there was no swaying him from his position when once he had taken a stand. The profession is greatly in need of men of the type of Dr. Barrett, and the world at large is the poorer because of his passing.

COUNCIL ON DENTAL THERAPEUTICS

COD LIVER OILS

IT has been shown that an effective concentrate of cod liver oil can be made and marketed. To be acceptable, such a concentrate should have a vitamin A potency of at least 10,000 U. S. P. units per gram (200 U. S. P. units per tablet or other dosage unit).

ACCEPTED NONOFFICIAL DENTAL REMEDIES

The following article has been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list of Accepted Nonofficial Dental Remedies. A copy of the rules which govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

WHITE'S COD LIVER OIL CONCENTRATE.—A cod liver oil concentrate in the form of tablets (wafers), each containing not less than 250 vitamin A units and not less than 100 vitamin D units.

Actions and Uses.—White's cod liver oil concentrate possesses properties similar to those of cod liver oil as far as these depend on the fat soluble vitamin content of the latter.

Dosage.—For adults, from 2 to 4 tablets (wafers) three times daily; for children over 5 years, 1 tablet (wafer) three times daily, after each meal; for infants, 1 tablet (wafer) daily, crushed and dissolved in the feeding.

Manufactured and distributed by Health Products Corporation, Newark, N. Y., from concentrate prepared by White Laboratories, Inc., Gloucester, Mass. No U. S. patent or trademark.

White's Cod Liver Oil Concentrate is obtained from cod liver oil by separation of the unsaponifiable fraction of the latter under anaerobic conditions. The vitamin A potency of White's Cod Liver Oil Concentrate is determined by a modification of the U. S. P. X method, differing from the latter in the use of a ration containing agar, irradiated yeast, "crisco" and dextrin, and in placing the emphasis on xerophthalmia as the criterion for beginning the feeding of the concentrate. When assayed by this method the product is required to have not less than 250 vitamin A units per tablet. Comparative assays using the preceding method and that of the U. S. P. X have shown the potency as determined by this method is fully the equivalent of that determined by the pharmacopeial method. The vitamin D unit is determined by finding the minimum quantity of concentrate which will produce in ten days a continuous line of calcium deposit on

the metaphysial side of the epiphysial cartilage of the tibias of rats made rachitic by means of vitamin D deficient diet 2965 (*Jour. Biol. Chem.*, 64, 263, 1925). When assayed by this method, the product is required to contain 100 vitamin D units per wafer.

SUGAR AND TEETH

The following special article has been prepared by Russell W. Bunting, professor of oral histology and pathology, University of Michigan School of Dentistry, at the request of the Council, which has approved the report for publication.

SAMUEL M. GORDON, *Secretary.*

There is considerable interest at the present time in the question of sugar and the place it should occupy in the dietary program. It is well known that sugar is a very concentrated form of carbohydrate and is readily transformed by the body into energy. It, therefore, has been recommended for growing children and for athletes.

On the other hand, the question is frequently raised as to the possible dangers which might come from the overconsumption of sugar. It is known that a large quantity of sugar in the diet may produce an inordinate increase in weight. It has also been claimed that a liberal consumption of sugar favors dental caries. Much has been said pro and con as to the relationship of sugar to the health of the teeth.

It is quite evident that highly sweetened foods retained about the teeth offer a very admirable pabulum for the growth of aciduric organisms, from which the acids of dental caries may be produced. In this manner, they directly affect the progress of dental caries. It is also possible that sugar may exert an important indirect influence on the health of the mouth. As a result of animal experimentation, it has been found that diets which are most conducive to dental caries are those which are unbalanced, that is, they do not contain a proper proportion of proteins, carbohydrates, fats, inorganic salts and vitamin bearing foods. From all of the nutritional studies so far made, the balance of the food constituents seems to be the most important factor in caries production thus far observed.

Sugar in the form of candy and highly sweetened foods is a very available and pleasant form of carbohydrate intake. Being so highly concentrated, very high caloric values may be ingested in relatively small amounts of food. In this manner, the natural hunger and caloric requirements may be largely satisfied by this form of carbohydrate, and the appetite for other foods which contain necessary nutritional principles which are not supplied by sugar is destroyed. Since sugar is not a complete food, and contains no food principles other than carbohydrates, any diet in which sugar takes a large place is necessarily an unbalanced ration and is, therefore, favorable to dental disease. An experiment which has been carried on by a group at the University of Michigan has maintained a large group of children on a well-balanced, low sugar diet. Among these children, over a period of one year, dental caries was reduced to a negligible quantity, even though adequate dental service or personal care was not provided. The data submitted by this group are very suggestive and

should point the way to further experiments to determine just how large a part sugar does play in the activity of dental caries.[1]

1. Bunting, R. W.; Hadley, Faith P.; Jay, Philip, and Hard, Dorothy G.: Problem of Dental Caries, Am. J. Dis. Child. 40:536 (Sept.) 1930.

ANNOUNCEMENT

The Committee on Pharmacology and Therapeutics of the Council on Dental Therapeutics of the American Dental Association announces that it has at its disposal a small fund to aid investigations which may be of therapeutic interest in the field of dentistry. The grants will be limited to the purchase of materials or special equipment. Applications should be addressed to the secretary, S. M. Gordon, 58 East Washington Street, Chicago, Ill.

BUREAU OF CHEMISTRY

EX-CEL TOOTH STAIN REMOVER, A HARMFUL PREPARATION

The following is a report from the A. D. A. Bureau of Chemistry.

SAMUEL M. GORDON, *Chief.*

THE insistence with which certain dental supply houses and nostrum dealers persist in selling preparations containing hydrochloric acid to the public and profession represents a real danger to the public welfare. This Bureau has had occasion to point out in the past the harmful character of these hydrochloric acid preparations sold to the uninformed public as tooth stain removers.[1]

Since the first report of Tartaroff was received, many communications have been received by the Bureau, especially from dentists in the South, asking whether something could not be done to protect the uninformed users against this sort of exploitation. The latest product to be brought to the attention of the Bureau is Ex-Cel Tooth Stain Remover (L. Silverman, Philadelphia, Pa.).

Reports from other sources on these harmful hydrochloric acid containing solutions have been published elsewhere. The New York Academy of Dentistry, through a cooperative arrangement with the Department of Biochemistry of Columbia University, has reported *in extenso* on several of these preparations, namely Taxi (Holland Specialty Co., Peoria, Ill.), Stain-Remover (Ransom and Randolph Co., Toledo, Ohio)[2]; Bleachodent (Bleachodent Dental Laboratories, Inc., New York and Toronto), Ekay (Film Off Company of America, Inc., New York), Ex-Tartar (Detroit Pharmacal Company, Inc., New York City), and Snowy-White (New York Research Laboratory, New York City)[3].

More recently, a dentist in Ohio wrote to the Bureau concerning a preparation made in Philadelphia, sold under the high-sounding name "Ex-Cel Tooth Stain Remover" and stated on the label to be "endorsed by the dental profession; harmless to enamel and gums." This dentist wrote as follows:

> My attention has been called to a preparation offered for sale by L. Silverman, 1033 Chestnut Street, Philadelphia, called "Tooth Stain Remover." I was fearful that this was another of the highly acid products and sent for a bottle of it (8 oz. bottle now 50c) and find it highly destructive to tooth structure, and therefore capable of great harm. . . .
>
> It is of interest that whole teeth put into this preparation will have the minerals so completely removed that the organic matter will float in a short time.

In view of these statements, Ex-Cel was submitted to examination. The report of the American Dental Association Bureau of Chemistry follows.

1. Tartaroff, J. A. D. A., 15:2167 (Nov.) 1928; Helping the A. D. A. Bureau of Chemistry to Help the Public, ibid., 17:344 (Feb.) 1930.

2. J. Dent. Res., 7:477 (Dec.) 1927.

3. J. Dent. Res., 10:481 (Aug.) 1930.

CHEMIST'S REPORT

"Two (2) original bottles of Ex-Cel Tooth Stain Remover (L. Silverman, 1033 Chestnut St., Philadelphia, Pa.), price 50 cents each, were submitted for examination.

"Each bottle was labelled as follows:

Ex-Cel, Tooth Stain Remover. Endorsed by the Dental Profession.

Harmless to gums.

Directions: Dip cotton applicator into solution. Apply to stained area. Discoloration will disappear immediately.

"Each bottle contained approximately 435 c.c. (15 fluid ounces) of a red liquid possessing a sour taste, an acid reaction to litmus, and an irritating odor, indicative of strong hydrochloric acid. The inside of the metallic cap was corroded.

"The specific gravity at 20 C. was found to be 1.0772.

"Qualitative tests indicated the presence of chlorid, sulphate, iron and calcium. Aluminum, zinc and magnesium were indicated in a very small amount. Nitrate, phosphate, fluorid, sodium and potassium were not found. Chlorid was not found in the ash.

"The p_H (hydrogen ion concentration) of the liquid determined electrometrically, was found to be 0.2.[4]

"Quantitative examination yielded:

Total solids (100 C.) . . . . . 0.30 gm. per 100 c.c.
Ash (650 C.) . . . . . 0.07 gm. per 100 c.c.
Titratable acidity (c.c. N. acid) . . . . 472.2 c.c. per 100 c.c.
Titratable acidity calculated as HCl . . . . . 17.24 gm. per 100 c.c.
Chlorid (Cl^-) . . . 16.61 gm. per 100 c.c.
Hydrochloric acid (HCl) . . . . . 17.09 gm. per 100 c.c.
Sulphate ($SO_4^=$) . . . 0.20 gm. per 100 c.c.

ACTION OF EX-CEL ON TEETH

Experiment No.	Liquid Used	Time of Contact	C.c. 0.042 Normal $KMnO_4$ per 2 C.c.	Mg. Calcium (Ca^{++}) per 5 C.c.
1	Ex-Cel	None	0.40	0.84
2	Ex-Cel	1 min.	1.49	3.13
3	Ex-Cel	2 min.	5.20	10.9
4	Ex-Cel	5 min.	11.60	24.4
5	Ex-Cel	10 min.	22.15	46.5
6	Ex-Cel	20 min.	40.50	95.1
7	Ex-Cel	30 min.	96.05	201.7
8	Ex-Cel	60 min.	10.72x10*	225.1
9	Ex-Cel	24 hr.	18.25x10*	383.3
10	Distilled Water	24 hr.	0.10	0.21

*Owing to the large amount of calcium present, it was necessary, in these two cases, to dilute the solution containing the liberated oxalic acid to 250 c.c. and take a 25 c.c. portion.

"From the foregoing, it may be concluded that Ex-Cel Tooth Stain Remover is essentially a 16 per cent solution of

4. As will be recalled p_H is the modern chemical symbol used to express the degree of acidity and alkalinity. For instance, water, which is neutral, has a p_H value of 7. All values numerically below 7 indicate relative acidity; thus the p_H of gastric juice, that is, 0.2 per cent hydrochloric acid, is 1.7. The p_H of the normal saliva is approximately 6.8-7 (slightly acid to neutral), while that of blood is 7.4-7.6 (slightly alkaline). p_H 0.2 indicates a strongly acid solution.

hydrochloric acid in water[5] containing some impurities. A solution having the essential properties of Ex-Cel may readily be prepared by mixing 1 part of technical hydrochloric acid and 1 part of water. The cost of material necessary to make 15 fluid ounces of such a solution would be approximately 1 cent.

"In order to determine the amount of calcium dissolved from tooth structure, the following examination was carried out.

EX-CEL
TOOTH STAIN REMOVER

ENDORSED BY THE DENTAL PROFESSION. HARMLESS TO ENAMEL OR GUMS.

DIRECTIONS:
DIP COTTON APPLICATOR INTO SOLUTION
APPLY TO STAINED AREA. DISCOLORATION WILL DISAPPEAR IMMEDIATELY

L. SILVERMAN
1033 CHESTNUT ST.
PHILADELPHIA, PA.

Doctor: Do you agree with L. Silverman that hydrochloric acid is harmless?

ACTION OF EX-CEL ON EXTRACTED TEETH

"Freshly extracted teeth (approximate weight 1.5 gm. each) were placed in 5 c.c. of Ex-Cel for definite lengths of time, removed, and the calcium content of the solutions determined by taking a 2 c.c. portion, precipitating the calcium as calcium oxalate and subsequent titration with potassium permanganate. The calcium content of 5 c.c. of Ex-Cel and 5 c.c. of water in which a tooth had been placed for twenty-four hours was also determined. The results are given in the accompanying table.

"On immersion in Ex-Cel, gas bubbles formed on the surface of the teeth immediately. The tooth which had been in Ex-Cel for one hour was examined, and it was found that the enamel could be peeled from the tooth. The tooth which had been in Ex-Cel for twenty-four hours was soft and could be crushed between the fingers."

The chemist's examination indicated clearly that Ex-Cel Tooth Stain Remover is essentially a 1:1 solution of hydrochloric acid; 15 ounces of which could be put up for about 1 cent. The cost of material is unimportant when compared with the amount of harm inherent in one 15 ounce bottle of this acid solution. The examination indicates the harmful action of Ex-Cel on the tooth structure.

Dentists with the interest of the public welfare in mind can perform a public service by informing the members of their community as to the harmfulness of so-called stain removers made up of hydrochloric acid. Ex-Cel is the most concentrated solution of hydrochloric acid that has come to our attention up to the present time.

5. Sixteen grams of hydrogen chlorid per hundred grams of solution (17 gm. per hundred cubic centimeters). The U. S. P. X table for hydrochloric acid water solutions gives 1.0761 as the specific gravity for such a solution at 25C. (1.0770 at 20C.) This value is in good agreement for the value found for Ex-Cel.

BUREAU OF DENTAL HEALTH EDUCATION

PROSTHESIS IN CHILDREN'S DENTISTRY*

By FRANK BLAINE RHOBOTHAM, D.D.S., Chicago, Ill.

TO quote the late James H. Prothero:

Prosthetic dentistry is that branch of dental science which treats of the various methods of replacing the lost organs of the mouth in whole or in part, the artistic and mechanical processes involved in such restorations, together with a description of the physical properties and peculiarities of the various materials employed.

More specifically considered, prosthetic operations may be classed as follows: construction of crowns, bridges and dentures, obturators, and appliances for correcting defects of the palate, appliances for correcting irregularities of the teeth and jaws, appliances for retaining in position fractured bones of the face when reduced and the construction of metallic and porcelain inlay fillings.

It is the purpose of this paper to deal with only that phase of the subject which pertains to practical suggestions that may be employed during the childhood period. This material has been gathered largely from my experience in the actual application of the suggestions, which have proved helpful and timely.

Originality is not claimed in its entirety, for we all depend greatly on the sum of knowledge of the past for most of our present-day procedures. Any failure, therefore, to acknowledge properly the rightful contributors to any of this material is not wilful, but arises from a lack of knowledge as to where credit is due.

If there proves to be anything new in this offering, kindly accept it for whatever value you may place on it in your own employment of it.

CROWNS

1. *Gold Shell Crowns.*—These crowns are used to restore to anatomic size and form (a) the deciduous molar that is otherwise irreparable; (b) deciduous cuspids, particularly the upper, with proximal cavities in which so much tooth substance has been lost that retention form for a filling is impracticable. White gold meets the requirements of esthetics better than does yellow gold.

2. *Cast Occlusal Gold Crowns.*—These are applicable for hypoplastic first permanent molars. The ideal manner of restoring these teeth to their normal function as the keystones of the dental arch is to build them up with cast gold onlays, which may be replaced by porcelain jacket crowns in adult life. There are cases in which, owing to the painful operation necessary and the danger of causing death of the pulp, the onlay cannot be used. These are the molars that are so lacking in tooth substance that dentists, in desperation, often extract, not knowing what else to do. This is never necessary if the case is taken in hand in time, as the cast

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 24, 1930.

occlusal gold crown will restore the tooth to normal function.

3. *Partial Open Faced Gold Crowns.*—The application of these crowns is limited largely to central incisors that have been broken and are in need of protection during the period that additional dentin is being laid down within the pulp chamber. They may be used as a temporary measure only on very young teeth or in cases in which the fracture has resulted in a near exposure. Even when there has been an actual exposure which has been successfully capped over a period of weeks, this type of crown affords adequate protection for a year longer. After the exposed pulp has been capped, primary protection may be offered by cementing a celluloid form over the tooth.

4. *Porcelain Jacket Crowns.*—Because of the dangers of preparation and the possible normal recession of the gum tissue, these crowns are rarely indicated before from the sixteenth to the eighteenth year. In cases in which the crown of the tooth has been broken off and the root canal can be properly treated, it is well to build up a cone on the root and make a porcelain jacket crown.

5. *Porcelain Faced Crowns.*—In a few instances in which the permanent cuspids are congenitally missing and the remaining deciduous cuspids are so fragile and worn as to prevent preparation for porcelain jackets, this type of crown may be employed as a last resort. I have used several that have been giving service for years.

6. *Extension Gold Shell Crowns.*—These crowns are constructed by soldering an extension to a regular shell crown in the form of a flat slide. They are ideal for jumping an anterior tooth into normal occlusion in specially selected cases. They are not indicated where there is insufficient space between the approximating teeth to allow easy passage of the tooth that is out of occlusion or in cases in which the malocclusion is extreme. They may be placed on either upper or lower teeth according to adaptability, but when used on a lower anterior tooth, the latter should be made more stable by having wings added to rest against the adjacent teeth.

Cast gold crowns may build up deciduous molars to occlusal efficiency in cases in which the bicuspid is congenitally missing. This, of course, depends on the substantiality of the roots of the deciduous molars.

BRIDGES

There are two outstanding reasons for using bridges during the deciduous period: (1) to prevent collapse of the arch, and (2) in the anterior section of the mouth, to prevent speech defects. It must be remembered that because of the normal forward drift of the first and second permanent molars, the most important period at which to prevent loss of space in the posterior part of the mouth is between the ages of 4 and 12. Normally, there is an anterior development beginning about from the third to the fourth year, and therefore there is little danger of collapse in that region after the fourth year, regardless of the presence or absence of the deciduous anterior teeth. Before the age of 4, it is well to maintain anterior space with some type of bridge. Too much emphasis cannot be placed on the value of an anterior bridge in the prevention of speech defects.

Owing to the fact that esthetics is not quite so important during the deciduous period as are function and stability, the abutments of bridges should be made either of white gold shell crowns, open faced crowns or three-quarter castings.

It is well to allow for expansion in long spans and in young cases. Posterior bridges are rarely constructed, as the space is ideally retained by other mechanical appliances.

SPACE MAINTAINERS

Anterior space should be maintained by bridges as described above. There are many types that have been shown in clinics, but there seem to be two kinds that are the most successful to maintain space resulting from the early loss of deciduous molars (space between the first deciduous molar and the first permanent molar). A gold shell crown is made for the deciduous molar to which is cast a rod ending in ball contact loosely against the mesial contact point on the first permanent molar.

R. C. Willett, of Peoria, Ill., has advocated a technic for abutments of space maintainers that serves several purposes. He suggests a preparation for deciduous molars that consists of stoning the proximal surface and cutting retaining grooves with knife edge stones in such a manner that a gold casting can be constructed with little discomfort to the patient.

Dr. Willett also has shown an extension casting for the lower second deciduous molar which rests in the mesial occlusal pit of the erupting upper first permanent molar. This appliance not only prevents this molar from painful pressure against the gum tissue of the opposite jaw, but also holds or guides the tooth into normal occlusion.

PARTIAL DENTURES

Perhaps the most common need for the partial denture occurs when there has been an early loss of the permanent central incisors. Not infrequently, a central and lateral incisor are lost by trauma as early as the eighth year.

To replace the lost teeth, a "horseshoe" plate can be constructed and worn by the patient until maturity, at which time it may be replaced by some other type of restoration. The vulcanite "palate" is an ideal piece to preserve expansion that may have been accomplished by orthodontic appliances.

In cases in which there are congenitally missing permanent teeth with the natural shedding of the deciduous teeth, it is often necessary to construct partial plates to maintain space and allow for normal development.

FULL DENTURES

There are several cases on record in which all of the permanent teeth were absent after the shedding of the deciduous teeth. I had such a case in my practice in which I was called on to construct a full upper and lower denture in a patient aged 10. Dr. Willett reports a case in which infection called for the removal of all of the deciduous teeth at the age of 3. He constructed a full denture of vulcanite, which is giving the little patient a masticating apparatus and at the same time aiding in functional development.

OBTURATORS

Special appliances for the correction of defects of the palate need only mention here, but their service to the patient cannot be overemphasized, particularly as they are related to mouth and nose hygiene.

APPLIANCES FOR THE CORRECTION OF IRREGULARITIES

It is not within the province of this paper to discuss orthodontic procedures. There are several appliances for the treatment of habits that may be well included.

1. To correct tongue sucking and biting, construct a flat disk of vulcanite to fit the roof of the palate. Drill a hole in the center of the disk and attach to it a

string which may be made fast to the clothing of the wearer. The treatment consists in getting the patient to hold the disk against the hard palate while the string leads from the mouth and is tied to the clothing. To get the child to carry out this procedure, which will prevent bad habits of the tongue, it is necessary to offer a suitable reward. If patience is indulged in over a period of time, a new habit will be formed, that of keeping the tongue back in the mouth.

2. To prevent the bad effects of pushing the tongue between the anterior teeth, construct on the lingual aspect of bands cemented on all of the anterior teeth points sharp enough to make the tongue uncomfortable when it is pressed against them.

3. To prevent thumb sucking in older patients, construct a band for a bicuspid or deciduous molar on the upper left and right sides. To these bands, solder a bar that clears the vault of the arch by about one-quarter inch. This appliance cemented into place will prevent suction, and where there is no suction, there will be no sucking.

Special trays in a wide variety of sizes are needed in the efficient practice of prosthesis. In unusual cases and in cases in which small trays are not at hand, a special tray can be made by the use of heavy cardboard, which may be cut and folded to meet almost any emergency.

Large plaster impressions may be taken with little discomfort if the patient's head is brought forward after the insertion of the plaster, and instruction to breathe through the nose is given.

Splints and wiring that apply to oral surgery will not be described as there is nothing new to offer and the procedures belong strictly to that field of dentistry.

Permit me to insist on a more thorough use and understanding of the application of prosthesis during childhood.

55 East Washington Street.

DENTAL INTERNSHIP IN A GENERAL HOSPITAL*

By DANIEL F. LYNCH, D.D.S., Washington, D.C.

THE dental intern in a general hospital is no longer an idea. He is a fact.

The dental intern is a valuable adjunct to the house staff of any general hospital. To make this statement a few years ago would have brought forth many expressions of doubt on the part of those in a position to know. Yet today, all our fully equipped general hospitals include a dental intern on the staff. One of the points that I wish to stress particularly in this paper is that all dental internships are not identical.

As you well know, there are several kinds of medical internships. For instance, a medical man who accepts an internship in a general hospital has an entirely different training from that of a man who takes an internship in a psychiatric institution or in a state institution

*From the Department of Oral Surgery, Georgetown University Hospital.

*Read at the Twelfth Annual Meeting of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic and Mayo Foundation, Rochester, Minn., Oct. 8, 1930.

that is caring for chronic diseases. The same thing holds true in dentistry. A dental internship in a general hospital is entirely different from an internship in an institution for poor people and chronic invalids. Accordingly, let us understand what is meant by a dental internship.

By the term "dental internship," I do not mean simply dental service in a hospital. There are so many types and varieties of dental service that unless we make an attempt to classify them, we are apt to misunderstand each other. I shall not attempt to discuss all types of dental service for hospitals, but shall confine myself to that type of dental service which requires a dental resident in the hospital. Accordingly, I would group this type of service under three main divisions: (1) the general type; (2) the institutional type, and (3) the permanent staff type.

GENERAL TYPE

The general type would include all dental residents in general hospitals who receive no remuneration for their services except experience, room, board and laundry. The appointment should be for at least one year, and should not exceed two years. The intern should be a recent graduate with an aptitude for this type of work.

His work would be confined primarily to mouth examinations, prophylaxis, preoperative and postoperative care of dental patients, radiodontia, treatment of acute pulpitis, insertion of temporary fillings, extraction of teeth, the writing of all dental histories and the charting of all mouth examinations. He would assist in the operating room in all oral surgery cases, such as cervical cellulitis, harelips, cleft palates and fractured jaws.

INSTITUTIONAL TYPE

The institutional type would include all dental residents in sanitoriums (tuberculosis, "Keeley cures," etc.), state institutions (insane, houses for the poor, aged and chronic invalids, jails, penitentiaries, houses of correction, etc.). In such a place, the intern usually receives a small salary, ranging anywhere from $50 to $150 a month, including board, room and laundry. The salary is paid because the working conditions in such institutions are usually very unpleasant and the type of work is limited and unattractive.

The appointment is usually for one year, but the intern can generally remain two or three or more years if he so desires, and if he is liked by those in authority.

His work is similar to that of the intern in the general hospital except that there are fewer surgical cases. The bulk of his work will be restorative dentistry. He will make dentures for the patients that need them. He will put permanent fillings in teeth that need them, and, in many cases, if the patient can pay for it, he will do expensive bridgework. This type of internship has many drawbacks because it is not possible for an intern to care thoroughly for all patients in the institution. The result is that many of the patients are in the institution one or two years before they ever receive any sort of dental attention other than the primary examination and possible emergency work that comes up.

PERMANENT STAFF TYPE

The permanent staff type is the clinic or house staff dental service. This type would include all dental residents in special hospitals, large clinics and state and government institutions. The man appointed is usually not a recent graduate.

He is a man with much experience or special ability. His position is considered a permanent one and he gives his full time, doing all of the necessary dental work on all of the patients at a stated salary per year.

His work may be confined to oral surgery and the removal of all oral foci or it may include all branches of dentistry, depending on the type of institution he is in.

I offer the foregoing classification to help simplify the problem and to suggest a possible basis for the standardization of dental internships. At this time, I will discuss only the first division, or that type of dental internship best suited for the average general hospital. I realize that the ideal plan has not yet been worked out and that all local conditions require special handling. I therefore solicit your aid and criticism and I trust that the discussion will bring out many helpful suggestions. Franken[1] has summarized a few basic requirements for a dental service in a general hospital. He says that the following should be remembered:

1. As stated so ably by Brown, "The dental section is neither to be a part from, nor exist separately from, other medical activities." In other words, it should be on an equal basis with the other specialties.

2. There should be proper staff organization and selection, and the establishment of a regular routine.

3. Dental roentgenograms should be taken in the roentgenographic department or by a technician from that department and should be interpreted by a competent dentist.

4. There should be a separate dental sheet properly entered with every patient's history.

5. There should be constant cooperation with all of the various departments of the hospital.

6. Dental work should be of such a nature that it can be finished within the time the patient remains in the hospital.

7. Perhaps most important of all, the dental director should be selected entirely on his previous experience in hospital work. This cannot be stressed enough. Many institutions have dispensed with the dental department not because of a lack of need but because of the negligence or inability of the men appointed as directors. Therefore, all fraternal, political and social considerations should be ignored, ability and experience in hospital work being the only basis of selecting the head of the department.

It is not necessary that a hospital have an enormous sum of money in order to start a dental service. The cost of equipping a dental clinic in a general hospital is very reasonable. Franken has shown that a very efficient dental clinic can be established for under $600. Once a clinic is established, there is no reason that it should not be self-supporting, since there is usually a modest revenue derived from the extraction of teeth.

The question of a separate dental ward is one that seems to bother some institutions. I feel that a separate dental ward is unnecessary. I prefer to have such cases included in the regular surgical wards and try to avoid any differentiation that would seem to set dentistry apart from other surgery. This is a less expensive procedure for the hospital, and I am sure the more satisfactory one for most institutions.

1. Franken, S. W. A.: Dental Service in Hospitals—Its Problems and Their Solution, J.A.D.A., 16:2302 (Dec.) 1929; Dental Equipment: Its Cost and Installation in a General Hospital, Dent. Cosmos, 69:186 (Feb.) 1927.

The appointment of the dental intern should be made by the board of trustees of the hospitals on the recommendation of the director of the dental service of such a hospital. The intern should work under the direction of the chief of the dental service and should be responsible to him for all matters pertaining to the dental routine in the hospital. The dental intern should be responsible to the hospital directors for matters affecting hospital routine only. He should be on the same basis as the medical interns and should be governed by the same rules as affect the medical interns in the hospital.

For a number of years, at Georgetown University Hospital in Washington, we have had a dental service without an intern. The service was taken care of by two men who saw all dental cases that were reported to them by the medical and surgical services. They also devoted one or two half days a week in the outpatient department examining cases. For a while, the ward cases were examined routinely by one of the attending dentists. Because of the short period between his examination and the patient's dismissal he was unable to follow up his cases, with the result that only in the extreme cases were dental examinations taken into consideration and oral foci removed.

This year at Georgetown, we created a position on our staff for a dental intern. The intern is a recent graduate who lives at the hospital in the same quarters with the medical interns. He is on an equal basis both socially and professionally with the medical interns and he is under the supervision of the resident surgeon just as are the other surgical interns. He is held accountable for the mouth examinations of all ward cases. He must examine the patients' mouths and chart his findings within twenty-four hours after the admittance of the patient, unless the physical condition of the patient will not permit such an examination. He is not allowed to begin work on any of the ward patients until his recommendations have been approved by the medical attendant in charge of the case, and he can then proceed only with the sanction of the dental chief.

We have equipped a small inexpensive dental clinic which is located in the outpatient department, where the intern is stationed every afternoon during dispensary hours ready to examine all cases referred for dental examination. Cases requiring simple extractions he is prepared to handle. Any case which is considered difficult from a surgical standpoint, or any case that requires mature judgment for diagnosis is set aside for the attending dentist to examine. The dental service at Georgetown consists of three attending dentists and one dental intern. This is all that is necessary at the present time, but as the service increases, we are prepared to increase the staff.

In addition to the service to the hospital as a whole, this dental internship serves to give a recent graduate in dentistry a broader view and knowledge of dentistry in its relation to general medicine and surgery. Naturally, this appeals only to those men who wish to broaden their knowledge of dentistry as related to medicine. A degree in dentistry is therefore necessary, but a state license is not required. The presence of the dental intern in a hospital is of equal importance to the medical profession and to the dental profession. The dental intern enables the chiefs of the dental service to keep in intimate contact with the affairs of the hospital, and he is enabled to cooperate fully with the medical staff in working out the relationships of diseases of the mouth to general systemic disturbances.

It is well known that most dentists are wofully lacking in medical training and in hospital procedures. It is not uncommon for a physician and a dentist each not to know what the other is talking about because of the difference in terminology and chiefly because of a lack of appreciation of each other's problems. A dentist cannot be in a hospital and associate daily with medical interns without getting their point of view. He soon comes to appreciate that the mouth is not an isolated part of the human body, but rather a most important part of a whole human system, and any work that he does in the mouth is bound to have its effects on the rest of the body; and, conversely, any defect in another part of the body is very apt to give an oral manifestation. By association with the medical intern, the dental intern soon learns the medical vocabulary, and the medical intern begins to learn that the study of the teeth may be more important than he at first suspected.

The work of the dental intern more than affords the opportunity for a concrete example of the advantages of routine mouth examinations and gives the medical man a chance to see the results obtained by the removal of oral foci. The presence of a dental intern in a hospital emphasizes the importance of the care of the mouth to patients, nurses, medical interns and other attendants in the hospital. The lesson of oral hygiene taught to a patient while in the hospital may be one of lasting benefit to the patient. There are thousands and thousands of people who never go to a dentist and who have never heard that the teeth should be maintained in a state of health. A great percentage of these persons are to be found in the free wards of a general hospital, and when the dental intern has brought home to them the importance of caring for the mouth, it is a lesson that they not only take home themselves, but also carry to their friends.

CONCLUSION

This is one aspect of the large problem of dental internship. Here and now, I have neither the time nor the interest to enter all its ramifications. I wished to touch on the essential feature, which is the intern's place in the general hospital. There are many things to consider under this general idea, such as (1) the financial aspect of such service, with its opportunities for economies; (2) the great benefits to be derived by the intern, and indirectly by the dental profession, from such a contact; (3) the ways in which such a service might be begun on a small scale, as necessary in small hospitals.

I invite your cooperation, suggestions and criticism. With these, I can look forward to a new day in the story of hospital procedure in its completer relation to the well-being of humanity.

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SIGNIFICANCE OF CLINICAL EXPERIENCE AS RELATED TO PREVENTION FOR THE CHILD PATIENT*

By LON W. MORREY, D.D.S., Chicago, Ill.

MUCH has been written in the past few years regarding the probable cause and the possible prevention of dental decay. So many theories tenable and otherwise have been advanced that the dental profession is in a maze of bewilderment regarding this most important health problem.

Obviously, the ideal and most effective way to terminate dental disorders is to eliminate the cause. Scientists concede that the red wave of destruction which threatens to submerge our citizens is due mainly to our violations of many of the hard and fast rules of nature.

Interested and sincere research workers, eager to solve this problem, working from different angles and from different points of view, have built up an amazing array of scientific and sometimes unscientific data pertaining to the question. For instance, we learn from one source that defects of the deciduous teeth are entirely due to prenatal conditions; from an equally well informed source, we learn that prenatal diet or care has little or no effect on deciduous teeth, and that it certainly has no effect on the permanent teeth.

Between the period of 1900 and 1925, mouth cleanliness was quite thoroughly advocated as a preventive for diseased mouth conditions. So thoroughly was this idea exploited that serious controversies between the exponents of various toothbrush technics waged fast and furious. Millions of dollars have been spent in developing and advertising different types of toothbrushes and different types of tooth pastes. The public have tried them all more or less diligently, and certainly with indifferent success, as dental disorders are ever increasing. Now we are advised that the mere brushing of teeth has little, if any, effect on the progress of decay. In fact, several authorities have been known to state that the use of toothbrushes has done more harm than good.

Thus, the mass of evidence pro and con develops. With our diminishing faith in the efficacy of toothbrushes, we have turned, in the last few years, to diet as the solution of our problem. Calcium and potassium metabolism, vitamins, alkaline and acid intake influenced and regulated by the ductless glands are at the present time more or less popularly supposed to govern the progress of decay.

Diet and ductless glands, vitamins and vittles have absorbed our fancy, and teeth are continuing to decay with remarkable rapidity. This is not meant to be construed as an effort to belittle the excellent work of the handful of earnest and conscientious research workers who are endeavoring to solve the problem of dental decay. There is no doubt that the effort which these men are putting forth, to-

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gether with similar efforts by their successors, will enable some one to put his finger on the cause of decay. When this is accomplished, prevention will be at hand.

All of these exploded theories have had a tendency to create doubt in the minds of some regarding all preventive measures, even operative procedures. Statistics which a few years ago were accepted at face value are now reviewed with more or less cynicism. This is partially due to the fact that some of the oral hygiene reports of the past were brightly colored, painted with the optimism and enthusiasm of the writer, and partially due to the fact that they were not accompanied by uncontrovertible statistics.

This fact remains, that until the day arrives when science has lifted the veil from the whole problem, dentists must assume the responsibility of preventing the progress of decay. In other words, if a fire exists, the most important matter at hand is to put it out without pausing to conjecture at that time on the best means of fire prevention.

In view of our present limited knowledge of the cause, the most effective means to eliminate the decay which we all know exists in the mouths of at least 90 per cent of our children is efficient operative measures. There are no short cuts or bypaths or mysterious hidden formulas known to the profession at the present time which will effect a miraculous cure.

Simple, sane and systematic operative procedure will give us most beneficial results, as has been proved many times by clinic reports, and as this paper will again endeavor to prove.

I do not mean to say that dental operative procedure is the panacea of all dental ills. Certain systemic disturbances of which we know little, if anything, at the present time, are constantly tearing down and undermining the tooth structure of certain individuals. In the most persistent of these cases, the most painstaking dental operations in the world will not completely stop the progress of decay. But in at least 80 per cent of children, systematic operative procedure will prevent pulp involvement of the permanent teeth.

Ordinarily, children can be classified into three great divisions. The first division consists of children who are above normal dentally speaking. About 4 per cent of the average American school children fall in this group. Their teeth are well formed, sound and not prone to decay. Not all of these children are sound physically; some are underweight and even undernourished, and all may have other physical defects. Their teeth, however, are apparently immune to caries.

The second and by far the largest group are the normal children. At least 80 per cent of our school population fall in this group. They have the usual number of decayed teeth, approximately from four to six to each child. The deciduous teeth begin breaking down at from 5 to 7 years of age. The permanent molars, particularly the first molars, contain the usual number of pits and fissures. They may or may not have other physical defects, but most of them, at least 60 per cent of them, have one or more correctible physical defects.

Sixteen per cent of our children can be placed in the third or below normal class. These, because of systemic deficiencies, such as rickets, glandular disturbances, calcium deficiency and malnutrition, have serious dental defects.

Ordinarily, we need not worry about the fortunate child in the first division as he requires little or no dental attention.

Regular, systematic and sane dental attention alone can save the pulps of the

teeth of those children in the second class —the normal children.

The unfortunate 16 per cent in the third or below normal class require not only skilful handling by the dentist, but also expert medical attention and constant supervision of health habits in order to save the teeth. In spite of this care, pulps become involved and teeth are lost.

Briefly summing up the foregoing: We have at the present time an ever-growing healthy interest on the part of dentists and others regarding the cause and prevention of dental decay. In spite of the many theories advanced, sound and otherwise, the prevalence of children's dental decay is increasing. Because of this increase of decay and because several apparently feasible theories regarding prevention have exploded, some doubt has arisen regarding all preventive measures, including that of operative procedure.

Scientific research in this field must be carried to a satisfactory conclusion. But in the meantime, sane preventive measures of an operative nature must be pursued, as by that means alone from 80 to 84 per cent of our present dental ills can be corrected.

As proof of these statements, we present the results obtained by the operative work performed for approximately 500 children in the school dental clinic in Lake Forest, Ill. The children in Lake Forest schools are fairly representative of the mass of children found throughout the United States. A very few, probably 1 per cent, come from extremely wealthy families. Eighty-five per cent are the children of the managers and superintendents of the large estates in and about that city, together with the children of the gardeners, chauffeurs and domestic servants employed by the millionaire owners of those estates. Twelve per cent are children of tradespeople, the grocer, butcher, pharmacist and banker. Two per cent are children from absolutely destitute families, dependent entirely on charity not only for dental service, but also for food, shelter and clothing.

Seventy-five per cent of the children come from American stock. There are thirteen Hollanders, sons and daughters of gardeners employed on the various estates, four Scotch, eight English and four Irish born children, eleven German, two Jewish and sixteen Italian children, one Syrian family of three girls, three French and four Scandinavian children of the first generation, five Polish and two Czecho-Slovakians in school, and thirty-three negroes.

Thus, you can see that the children under observation and care are fairly cosmopolitan, both from a social standpoint and as to nationality.

The diet of these children is much the same as that received by the average American child elsewhere. They are taught in school, as most children are now taught, that milk, whole grain cereals, vegetables and fruit should form a large part of their meals. Like all children, some of them obey these teachings and others do not. The candy stores, of which there are several, all seem to do a fair business, and birthday parties and special occasions bring forth large quantities of cakes and cookies, proving that the mothers and housewives still retain the art of concocting these delightful, though dubious dainties.

In the matter of sunlight, the children of Lake Forest are more fortunate than the children of the cities, but they are no more fortunate than children in thousands of other towns as small or even smaller throughout the country who have infinitely worse teeth. Nor are they subject to either more or less outside nervous stimuli than other children in the aver-

age American town. On the whole, they are average American children, living in an average midwestern city, who have had the advantage of ten years of preventive dental care.

Sympathetic, sane and systematic service has been the keynote of the success of Lake Forest's dental plan. There have been five different dentists in charge of the work during the past ten years, so that its success is not due to the efforts of any one individual. Nevertheless, the prerequisite of each of the five dentists employed was sympathetic understanding of childen. Undoubtedly, many men applied for the position who were better operators than those employed, but in the estimation of the superintendent of schools and the board of education, they lacked this most necessary quality. A perfect understanding of children and their problems is a vital necessity in both private practice and institutional work if success is to be attained.

Saneness of operation is the next prerequisite. No trick dentistry is performed or attempted. One by one, these mouths are cleaned, the offending teeth are either filled or extracted, and the child is returned to the classroom orally rehabilitated.

The third important phase of the plan is system. Every fall, each child receives a thorough dental examination, and the findings are tabulated on his individual chart. As soon as the 500 children have been examined, notification slips are sent to the parents of all children having dental defects. These slips must be signed and returned to the superintendent's office, the parent designating whether the child's work is to be done by the school dentist or by the family dentist.

All children are eligible to receive dental care, and about 90 per cent of them do have their work performed at the school dispensary. No work is performed for any child unless a card giving consent is first signed by the parent or guardian.

Once a month, the operator spends from fifteen to twenty minutes in each classroom, examining the mouths of the children for cleanliness. The record of the condition found is noted on the regular monthly report card. In the spring, just prior to the close of school, each child receives a second thorough dental examination, and the parents are asked to have the necessary corrections completed during the summer.

Immediately after the fall examination, the school dentist begins operating for children in the kindergarten and the first grade. As rapidly as these are cared for, he proceeds to work for the children in the next higher grade, leaving the upper grades until the last. Emergency cases, which are extremely rare and which are usually the result of some playground accident, are cared for immediately.

Simplicity and saneness of operation have been the outstanding feature of the service rendered.

Prophylaxis, which every child in school receives once or twice a year, consists of brushing the teeth with floured pumice and toothpaste. Little scaling is necessary, but is administered when needed.

Extractions are all made under a local anesthetic. For the past seven years, these operations have been confined entirely to deciduous teeth. It is rare indeed that a permanent tooth needs extraction. When that need does occur, it is for an upper grade child who has moved into Lake Forest from a locality where school dentistry is not practiced.

Fillings are confined to silver amalgam for all posterior permanent teeth, silver and copper amalgam for posterior deciduous teeth and synthetic porcelain for an-

terior permanent teeth. Black copper cement is sometimes, although rarely, used, and then only in the deciduous molars.

Deciduous teeth with pulp involvement are treated and filled, provided the presence of a devitalized tooth, in the estimation of the operator, will not affect the child's health. If the child is below normal physically, the offending tooth is removed.

The need for pulp therapy, like extraction for permanent teeth, is extremely rare. The few cases are the result of accident on the playground or are due to caries in the mouths of children newly arrived from other cities.

The children pay a nominal fee for this work: 50 cents for prophylaxis, 50 cents for extractions, from 50 cents to $1.50 for amalgam fillings, and $1.00 for synthetic porcelain.

When the dental dispensary was inaugurated in 1920, one full-time dentist was employed. His hours were from 9:00 a. m. until 3:00 p. m., five days a week and ten months a year. Five years later, in 1925, dental conditions were so much improved that only a half time worker was needed. In 1926, a change in personnel necessitated the new dentist's working full time, but he too soon had the situation so well in hand that, for the past two years, he has been working on a half-time basis.

The point that I wish to make is that, with the system employed, the teeth of this group of children are in such good condition that it is no longer necessary to employ a full-time operator, and each year's statistics show a steady decrease in decay as well as in operations, as Table 1 shows.

These figures bear out the assertion that the children were average American children, as the first examination shows that they had an average of 4.7 cavities

TABLE 1.—STATISTICAL DATA

No. of Children	Decayed Deciduous Teeth	Decayed Permanent Teeth	Total No. Decayed Teeth	Children O. K.	Average No. Decayed Teeth per Child
September, 1920					
508	1705	716	2421	84	4.7
June, 1925					
483	148	125	273	357	0.56
June, 1930					
590	116	61	177	449	0.3

	State of Teeth			Color of Gums			Use of Toothbrush		
No. of Children	Clean	Fair	Dirty	Dark Red	Light Red	Pink	Daily	Occasionally	Never
September, 1920									
508	144	251	113	5	192	311	303	137	68
June, 1925									
483	402	81	0	0	8	475	384	77	22
June, 1930									
590	498	83	9	0	0	590	501	80	9

for each child, a figure which is more or less constant in dental surveys made throughout the county. Eighty-four of the original 508 children were without dental defects. In other words, 83.5 per cent had decayed teeth.

Ten years later, the children averaged 0.3 cavities to each child, which is almost as low as it is possible to attain, and 449, or 76 per cent, of the 590 children had no dental defects, an almost complete reversal of the figures of ten years ago.

Another interesting result of this ten-year service is that there are less cavities in the permanent teeth of the 590 children present in 1930 than there were cavities in the permanent teeth of the 32 eighth-grade children in 1920. (Table 2.)

TABLE 2.—RESULTS OF TEN-YEAR SERVICE

Eighth Grade—September, 1920	
No. of Children	No. of Decayed Permanent Teeth
32	99
Kindergarten and First Eight Grades—1930	
590	61

In short, we find but two-thirds the number of cavities in the mouths of nineteen times the original number of children.

During the past eight years, not more than eight first permanent molars have been extracted, and those were extracted for children who had moved in from other communities.

In checking up on the cleanliness of the teeth, we find that approximately 23 per cent of the children in 1920 had dirty teeth, which is also the average figure for average children as shown by various surveys. In 1930, only 1.5 per cent had dirty teeth.

To make the figures more interesting: In September, 1928, Lake Forest annexed new territory, which included one school of forty-four children. They presented forty-eight cavities, or one and one-tenth cavities per child. In June, 1930, there were forty-two children in this school with twenty-two cavities or fifty-two-hundredths cavities per child.

The fees paid by the children for this work more than cover the cost of material and interest on the investment, and in the past ten years, the small surplus has practically paid for the initial cost of installation. In other words, the clinic has paid for itself except for the dentist's salary, and if there is any truth in the statement that decayed teeth are the cause of mental retardation of the child, the dentist has not only paid his own salary, but the salary of an extra teacher as well.

In conclusion, I repeat that, with a group of average American children living under average conditions, systematic, sane dentistry will stop the progress of dental decay, and until science develops a better method, it is the most efficient weapon that we have to fight this disease.

ARE DENTAL EXTENSION COURSES A SUCCESS?*

By JOSEPH B. JENKINS, D.D.S., Oklahoma City, Okla.

SUCCESS is based upon fulfilment of aim, desire, effort and expectation. The purpose of dental extension courses is to disseminate practical, helpful instructions to individuals not so situated as to be able to carry on resident study. This service has been extended to the medical profession in Oklahoma and North Carolina for a number of years, with no uncertain success, in that it has supplied instruction to men at or near their homes with the minimum loss of time from their practices, and at the least expense.

The object of educational institutions is, primarily, the administration of knowledge. This knowledge, when digested, becomes wisdom. Wisdom must be our guide in our upward struggle to light and health. Research and learning are advancing as never before. Discoveries follow on each other so fast that it is a wise man who can even know what is taking place about him, much less comprehend it all. The rapid advances made in the healing sciences in the past decade have made postgraduate study almost imperative. Especially is this true of the dental arts and sciences.

The dental graduate of ten years ago must have faithfully continued his studies and reading in the years that have elapsed, else he has found himself far in arrears in his training, mental equipment and later improved methods and developments, with consequent betrayal of the confidence reposed in him by his clientele. Owing to these rapid advances and improved methods of service, there has arisen the expedience of postgraduate courses of instruction for dentists in established practice.

Doctors both of medicine and of dental surgery have attempted to meet this expediency by (1) resident postgraduate study for credits; (2) correspondence study under college and university direction; (3) short courses of resident study in colleges and universities; (4) a postgraduate plan of state society meetings, under the auspices of the state society; (5) postgraduate courses offered by state universities under the circuit plan, in cooperation with state societies.

It is this last plan I wish to discuss. In order to do this more intelligently, I must relate something of the features of the courses named.

Postgraduate study formerly meant resident work in an institution granting credit for work done, usually compelling the doctor to leave his practice for a considerable time, with its attendant financial sacrifice; which only a comparatively few felt willing or able to meet. This almost prohibited postgraduate work to men in established practice, who consequently felt compelled to deny themselves and their clientele this much needed advantage.

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Postgraduate study by correspondence instruction had its limitations owing to the absence of class spirit, mass enthusiasm, personal contact with the instructor and clinical demonstration.

Short courses offered by colleges and universities could reach only a limited number owing to the inability of the doctors to leave their professional duties to do resident work, even for a limited time.

Recognizing the necessity for such a procedure, the Oklahoma State Dental Society eighteen years ago adopted and executed a plan for postgraduate instruction, suggested and introduced by the late Dr. B. L. Shobe. This plan, which has met the existing need admirably, has proved its worth and has been adopted by many other state societies, became known as "The Oklahoma Plan" of annual state meeting.

By this plan, the state dental societies engaged as instructors a staff of outstanding dentists, adept in their several specialties and in instruction. From four to six men comprised the teaching staff, the members of the state society were divided according to their choice into the several classes, and, for one week, intensive instruction and clinical demonstration was given the class along the line of this special phase of dentistry. In the years following, each man could enroll in a different class, getting special instruction for a week in a subject other than that already studied. The instructors were frequently changed from year to year, and the membership enabled to get other instructors' conception and teaching, thereby broadening their understanding. The cost to each member for the several courses varied from $25 to $60 for the week, this being paid into the treasury of the state society and called the postgraduate fund. This plan showed a nice residue after all expenses and honoraria were deducted. It resulted in a marked improvement in the skill and training of the rank and file of the dental profession, they having received training equal to that obtained by men who incurred the expense and loss of time to go to centers of dental instruction for special postgraduate work; and at far less expense.

This plan was followed with success for eighteen years. It was a fair example of cooperation and teamwork. Some of the dentists in small towns and rural communities are outstanding in their ability, some having had as many as ten courses in postgraduate instruction. I recount this project to pave the way for what is to follow. The institution of university extension postgraduate courses in Oklahoma came about as follows:

There are about 758 practicing dentists in Oklahoma, about 420 of whom are members of the state dental society, to whom only were the postgraduate courses available, many ethical dentists being excluded by reason of nonmembership.

There were, in 1928, in the grade schools of this state, about 700,000 school children, 557,000 of whom were in need of reparative and preventive dental service. The director of dental health education in the state department of public health, and other public health agencies in the state, had been directing parents to take their children to their local dentists for attention to these dental needs.

The apathy of dentists toward children's dentistry was so general throughout the state that their needs were sadly neglected and many children were still uncared for. This apathy was largely due to the fact that dentists generally preferred not to work for children, because of the difficulties encountered, the uncertainties of success in doing work for chil-

dren, jeopardy of professional reputation due to this uncertain success, the indifference of parents and their lack of appreciation of the health value of child dentistry, and the invariable financial loss to the dentist attempting to do such work.

It soon became evident that the solution of this problem lay in offering a special course of postgraduate study in pedodontia which would tend to correct the situation in all its phases. Such a course had never been offered by the state society owing to its great unpopularity. By arrangement between the university extension division and the state dental society, with the aid of the director of dental health education, a plan was worked out and offered to the district dental societies in their annual fall meeting which was unanimously adopted.

The plan I shall outline somewhat in detail since it is that typically arranged for administering noncredit courses for professional groups in active pursuit of their professions. The plan was somewhat after that on which physicians were being given postgraduate courses of study, both in North Carolina and in Oklahoma. The dentists were enrolled for the course, and the instructor, Philip Thomas of Minneapolis, Minn., was chosen for his success in practice, clinical experience and teaching ability. The state was divided into six geographic sections, and a city selected as near the center of population of each section in which classes were to be held as possible.

The fee was set at $25. This was to offset a portion of the administrative expense, cost of advertising the course to the dentists, traveling expenses of representatives, postage and printing. Out of this fund, the instructors' honorarium and all expenses were to be paid.

This course was open and available to all ethical practicing dentists whether in the state society and American Dental Association or not, in this respect differing from the plan put on by the state society in former years.

Owing to Dr. Thomas' death in November the course was postponed, and Thomas B. McCrum of Kansas City and Paul Barker of Denver, two well known pedodontists, agreed to put on the course.

The course began in April and continued for five weeks, as follows: The instructor met his class at one of these central cities on Monday, gave his instruction, drove the next day to the adjoining district, met the class at the most centrally located city, gave them exactly the same instruction given the day before at the first city, and so proceeded until he had made the entire itinerary of the five cities. The following week, the same itinerary was covered in this order with the second lecture, clinic or demonstration; and so on for the entire five weeks' course.

This necessitated much traveling for the instructors, and occasionally hardships, since the weather and roads in Oklahoma are not always ideal at all seasons of the year. Likewise, many of the class members were compelled to drive for considerable distances for each lecture, totaling in some instances 600 to 800 miles.

No credit was given for completion of the course, but an attractive certificate bearing the instructor's signature and those of the president of the state society and dean of the university extension division was mailed to each.

At the expiration of the first course, a questionnaire was circulated, addressing all class members to determine the reaction to the first course. The replies were left anonymous to assure frankness, and the answers returned and tabulated. Of the eighty-two men who took the first

course, eighty replied that they would sign for the next course offered, the instructor, the time of year, the fee and the subject being agreeable. Eighty voted the course a success, many giving such reasons as: increase of public interest and confidence in the dentists' ability; improvement of technical skill; demonstration of child management in the dental office; increase of income; excellent publicity for dental service; help in standardizing case procedure, and development among the dentists of a "child tooth consciousness."

Some discussion has occurred between the university extension division and the officers of the state dental society in Oklahoma about postgraduate instruction at the state meeting. The university has been largely guided in this matter by the wishes of the state dental society. Questionnaires circulated the first year disclosed that the larger percentage of the dentists of the state preferred the courses given out over the state in these various centers, for the reason that it required less time from their practice of dentistry, and eliminated the necessity of closing the office for an entire week, with its attendant loss of revenue. The extension division of the Oklahoma State University expresses a willingness to assist in sponsoring postgraduate instruction during the week of the state society meeting if requested to do so. In the event such a course should be adopted, it would amount largely to the same plan as was originally pursued in this state as "The Oklahoma Plan" of postgraduate work already described in this article and pursued with success for sixteen years. There would exist this difference: the fee for enrollment would probably be less and the burden of administrative affairs would devolve on the extension division instead of the already burdened officers of the state dental society.

With the first postgraduate course of instruction under the circuit plan as a basis, the university extension division offered a second course to the Oklahoma dentists along the same plan. For this course, a faculty of five men were chosen from the Northwestern Dental College of Chicago, including the dean, Arthur D. Black. It was this school which furnished the teaching staff for a similar course put on in the state of North Carolina two years ago. The enrollment for the course was made up of almost exactly the same men enrolled for the first course. Practically no nonmembers of the American Dental Association enrolled, nor were any drawn into the association, as it was hoped that they might be.

The probability of future courses in the state will depend on the continued cooperation of the state dental society with the extension division. Thus far, the officers of each institution have been most pleasant, congenial and inspiring. Next year, it seems to be the wishes of the officers of the Oklahoma Dental Society, as well as the officers of the dental district societies, to have the postgraduate program as a part of the district annual meetings. The university is preparing to cooperate and act in accordance with these wishes.

CONCLUSION

University extension courses of instruction in dental sciences have proved a success in this state in that:

1. They have supplied much-needed and valuable instruction to the practicing dentists.

2. The dentists were able to take advantage of the class attendance with a minimum loss of time from regular office practice.

3. The lectures are given at intervals sufficiently separated to permit of thor-

ough digestion and application of each.

4. By cooperation, the enrollment fee was held to a minimum and yet satisfactory honorariums were paid to the instructors.

5. It has served to stimulate renewed interest in professional study, and aroused enthusiasm for a vitally important department that had hitherto been regarded with indifference. The clients of these dentists taking the courses of study are receiving a higher standard of service.

6. Plans are under way for the continuation of extension courses with some minor alterations of details now under consideration.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Evaluation of Dental Roentgenographic Shadows: In an endeavor to evaluate dental roentgenographic shadows, William A. Lurie *(Am. J. Surg.,* September, 1930) classifies these shadows as follows: Those film densities which portray the soft tissues are classified as Grade 1. The shadows of bone parts with their greater inorganic salt content and greater resistance to roentgen-ray penetration are classified as Grade 2, under which there are two subdivisions: a, the loose alveolar type of cancellous bone seen about the jaws and in which the roots of the teeth are imbedded, and b, the densely compacted bone as represented by the teeth and the bone cortex, under the heavy periosteum. Grade 3 shadows embrace those associated with all types of filling material and are normally found within the tooth or within the root canal as filling material or a replacement for a decayed portion of tooth, which should restore the normal contour of the size of the tooth. Each grade of shadow has its individual characteristics and its anatomic position in which its portrayal will indicate its normal or pathologic extent. As with improper portrayal, each may be distorted, it is necessary to understand the anatomy of the teeth and jaws, the variations possible within the normal development of the parts or their alteration due to repair. The finding of a shadow typical of a certain grade in the position or of the shape normally that of another, or the alteration of the shape of a shadow in any grade of tissue from that recognized as normal calls for an explanation of the condition as either a normal process or a pathologic lesion.

Phosphorus in Rickets: The author, Edward L. Compere *(Am. J. Dis. Child.,* November, 1930) was able to secure for his study some of the most severe cases in the city of Chicago. The cases, numbering twenty-nine, were studied at intervals of from three to six weeks. The less severe cases were not included in the findings, the series reported including ten cases with one control. The following conclusions were reached: Phosphorus alone is not sufficient medication to bring about healing in severe cases of infantile rickets in which there has been no initial stimulation from ultraviolet light or from cod liver oil. The latter administered alone, from 3 to 6 teaspoonfuls daily, brought about healing in most cases, i.e., all but two. When phosphorus was administered in cases in which cod liver oil had been given and in which its administration was continued and other conditions such as diet and home hygiene remained the same, prompt healing and increase in calcification of the shafts of the bones resulted. When patients had received elementary phosphorus in the form of 2 one-hundreth grain pills a day for several months without improvement in the roentgenographic appearance of the bones, the healing response to the addition of cod liver oil was slow and the cure of the rickets sometimes delayed for several months, although in every case so studied, healing eventually occurred. The combinaton of cod liver oil and of phosphorus administered to patients with rickets who had not received previous antirachitic treatment, even though this therapy was begun in the late fall or winter months when the incidence

of rickets is known to be high, brought about prompt healing with marked calcification and increased density of all of the bones studied by means of the roentgen rays. The combination of cod liver oil and phosphorus produced more prompt and more certain healing of rickets than did cod liver oil alone.

Calcium Fixation: Four cases, and several animal experiments, were studied by E. J. Berkheiser (*Am. J. Surg.*, November, 1930), to determine whether calcium fixation could not be promoted by reinforcement of the diet with the mineral in a form more easily assimilable than that found in food. A mixture closely related to the mineral found in normal bone and tooth structure was administered to a series of patients and experimental animals, as follows: combined calcium salts, 2 grains phosphorus (lipoid) three-fourths grain; magnesium salts, one-seventh grain; silicic acid, one-fifth grain. The patients were a boy, aged 13; a man, aged 40; a man, aged 30, and a woman, aged 55. The period of nonunion varied from a few months to four and one-half years. In the first case, nonunion was revealed seven months and four days after the fracture was reduced, when the roentgenogram had shown the fragments in perfect position. Union was complete four and one-third months after reinforcement of the diet. In the second case, over three and one-half years passed without satisfactory union, and amputation was advised by many. Seven months after reinforcement of the diet, firm union was revealed on examination with the roentgen rays, since which time the patient has received no treatment and has been doing manual labor. The third patient had marked anemia from donating blood for several transfusions. Union continued very unsatisfactory for a period of three and one-half months, when the diet was reinforced. The patient gained several pounds, his anemia disappeared and firm union of the fractured elbow ensued. In Case 4, the neck of the femur was fractured, January 14. April 1, as there was a definite space between the fragments, the diet was reinforced. Films taken May 25 reveal definite solid bony union. Animal experimentation bore out the findings in the human cases studied.

Disease Factors Modifying Gas-Oxygen Technic in Exodontia: Fear and shock are regarded by E. I. McKesson (*Cur. Res. Anes. Anal.*) as to be classed as virtually disease conditions in proposed anesthesia. Premedication is suggested, and anesthetization without delay, with nitrous oxid alone, as thus the least discomfort results to the patient. The gas is administered under 5 mm. hg. pressure to prevent the sensation of suffocation, and the nasal inhaler is used as more acceptable to the patient than the face inhaler, unless there is some nasal obstruction. If respiratory efficiency is questioned, it should be measured and corrected if possible. A respiratory exchange, generally speaking, of less than 200 c.c. per breath and of less than 4,000 c.c. per minute borders on the dangerous, if it is not actually productive of asphyxia. Brawny indurations of the jaw or neck from extensions of acute infection may be of such magnitude as to endanger life from asphyxiation, as may neck tumors. Gas should be administered under from 10 to 20 mm. pressure. Light anesthesia is indicated as relaxation of muscles in deep anesthesia further embarrasses the already labored breathing. In these cases, the mouth pack should be firm and well placed to keep the gas under pressure in the pharynx. In pronounced anemia, blood examination is necessary, and a transfusion lessens the danger of secondary hemorrhage and renders anesthesia safer and easier. In cases of primary anemia, patients should be slowly anesthetized, the anesthesia beginning with high percentages of oxygen and low percentages of nitrous oxid, and either increasing or decreasing the percentage of oxygen in the mixture as subsequent muscular signs may indicate. The anesthetic gas is carried more readily than is oxygen, and a marked anoxemia may endanger the nervous system. In moderate cases, the response to the ordinary technic is normal. In secondary anemia, perhaps following massive hemorrhage from some accident, a moderate dose of morphin is very helpful in relieving the bodily demands for oxygen. Slow induction with gradual reducing percentages of oxygen leading into the desired plane of anesthesia is the logical and safe procedure. In advanced tuberculosis, effort is directed to prevent labored respiration by the administration of morphin, one-sixth grain, forty-five minutes before anesthesia, and a light nitrous oxid-oxygen anesthesia administered with care to prevent obstructive and ineffective breathing. In asthmatic conditions, the only unusual demand is for the use of adequate pressure in order to secure prompt anesthesia and to promote easy inhalation. In serious heart ailments, as indi-

cated by great shortness of breath and marked irregularity, light nitrous oxid-oxygen anesthesia, with plenty of time for careful induction to discover the best mixture, is essential. The author states: "Deliberate, careful operating, guarding against any encroachment on free breathing, is necessary. I have never seen a well-advanced cardiac case damaged by a careful nitrous oxid-oxygen anesthesia." As regards hyperthyroidism, the author says: "As infected teeth are sometimes responsible for an aggravation of this condition, many of these cases are sent to the dentist before treatment of the thyroid gland. The degrees of toxemia range from slight to fatal cases. The moderate case may pass unnoticed unless care is taken to detect it. Sleeplessness, flushing of the face, fine tremor of the hands, with slight enlargement of the neck, bulging of the eyes and a high metabolic rate should warn of the presence of this disease. Excitement, pain or worry markedly aggravates the condition in disease. They are best controlled by a preliminary dose of morphin, one-fourth gain, three-quarters of an hour before the operation, and a light nitrous oxid-oxygen anesthesia. It is wise, in severe cases, to complete the operation within fifteen minutes if possible, and to do what is to be done at one operation, since anxiety over another impending operation may be a serious handicap to the patient's recovery." In cases of status lymphaticus, no difficulty has been experienced with the ordinary technic except in two children in the same family. Deep seated obstruction to the air way was overcome by the administration of oxygen under sufficient pressure to inflate the lungs two or three times with the face inhaler. The author concludes that in ambulatory patients, deviations from the normal technic of administration are seldom necessary. He warns the dentist to be on the lookout for conditions bearing on the potency of the air passages.

Kidney Function in Pemphigus: Eight cases of pemphigus, a skin disease characterized by the formation of bullae, which, after absorption, leave pigmented spots, and usually involving the general health, are reported by Samuel Ayres, Jr. (*California and West. Med.*, August, 1930). The author terms this the most serious disease with which the dermatologist comes in contact. He says: "The fact that the disease is relatively uncommon makes it all the more imperative that all possible information be assembled in each individual case, for it is only by such means that a rational therapy will be developed. Foci of infection, not only of the teeth, but also of the sinuses, tonsils, gallbladder, prostate, etc., deserve more consideration. A more rigid examination of the bacterial flora found in the frequently diseased gums and the teeth of pemphigus patients might yield some valuable clues as to etiology. The possibility that the cutaneous manifestations and the damaged kidneys of pemphigus are merely the toxic effects of relatively common mouth bacteria, such as streptococci or Vincent's organisms, is worthy of further study."

Perlèche of Adults: Five cases of perlèche are reported by Skolnik (*Arch. Derm. & Syphilol.*, October, 1930; abstr. *J. A. M. A.*). They were all bilateral and chronic and were in adults. Organisms, identified as cryptococci, were cultivated from the lesions in each case. Inoculation of a pure culture of cryptococcus made under the normal breast produced a lesion similar to those at the angles of the mouth, which disappeared spontaneously within from three to four weeks. Cryptococci were isolated from this experimentally produced erosion on the first of three attempts, which was on the fifth day. No yeasts grew from scrapings cultured on the tenth and fifteenth days. Control cultures made from the angles of normal mouths revealed only bacteria.

Dentigerous Cyst of Antrum of Highmore: The unilocular cyst seen by Harris and Weidlein (*Arch. Otolaryngol.*, September; abstr. *J. A. M. A.*) completely filled the antrum, and, despite its great size, had formed no fistulous tract into either mouth or nose. There were, however, two large bony dehiscences. It contained a poorly developed supernumerary molar, indicating that the cyst had taken its origin from an aberrant tooth bud or so-called follicle. The cyst bore no direct relation to the left canine tooth, which was unerupted and missing from the arch. This tooth, anchored by a shelf of bone, lay wholly outside the cyst. This cyst was of exceptionally long growth, as evidenced by its size and the impacted canine, which normally erupts between the tenth and thirteenth years of life. It may be concluded, therefore, that the shelf of bone that anchored the tooth so securely was gradually driven into the side of its root by the slowly forming cyst over a long period of years.

Intraoral Cancer: All cases of intraoral malignancy should be given the benefit of radiation therapy. In the advanced lesion, it is always a good palliation, and in the early lesion it gives results on a par with more radical procedures. Those patients who are operable and who have not shown sufficient response to irradiation should be cared for by electrosurgery.—Albert Soiland and Orville N. Meland, in *California and West. Med.*

MISCELLANY

BOOK REVIEWS

A Practical Medical Dictionary of Words Used in Medicine with Their Derivation and Pronunciation, Including Dental, Veterinary, Chemical, Botanical, Electrical, Life Insurance and Other Special Terms; Anatomical Tables of the Titles in General Use, and Those Sanctioned by the Basle Anatomical Convention; Pharmaceutical Preparations, Official in the U. S. and British Pharmacopoeias and Contained in the National Formulary, and Comprehensive Lists of Synonyms. By Thomas Lathrop Stedman, A.M., M.D., editor of the "Twentieth Century Practice of Medicine" and of the "Reference Handbook of the Medical Sciences," formerly editor of the *Medical Record*. Eleventh, Revised Edition; illustrated; price, $7.50 net; published by William Wood and Company, New York.

This work in its present edition consists of 1222 pages of rather small type which shows the amount of material between its covers. It is really a colossal work of great merit, but it is somewhat marred by a controversial spirit in the preface over the spelling of certain terms. The rule adopted some years ago by lexicographers in general to drop the final "e" in such words as chlorine, chloride, etc., has been strenuously fought by the author of this dictionary from the first, and in the preface to the present edition, he does not try to disguise his satisfaction in the fact that largely through his influence some of our editors and writers are resorting to the original spelling. So far as THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION is concerned, it will continue to follow the rules of the Committee on Nomenclature of the Association in its annual reports, and these have decreed that the "e" shall be omitted.

An Outline of Oral Surgery for the General Dental Practitioner. By James L. Zemsky, D.D.S., New York City, author of "Oral Diseases," attending oral surgeon to the Midtown Hospital, N. Y.;; lecturer on Oral Surgery, Postgraduate Courses, Allied Dental Council; member Fédération Dentaire Internationale and various dental and stomatalogic societies; illustrated with 115 engravings made from original roentgenograms and photographs; price, $4.50; 171 pages; published by Physicians and Surgeons Book Co., Brooklyn, N. Y.

It is the purpose of the author of this volume merely to treat with more or less brevity those phases of oral surgery which may be acceptably handled by the general practitioner. The more detailed or intricate consideration of the subject is left to the larger textbooks. To those operators who assume that it is their province to take care of all the ordinary cases of surgery of the mouth, and who still conduct a general practice, this book is valuable, and it will serve a useful purpose. The author deals chiefly with the common ailments of everyday practice, the cases that every operator is likely to encounter in the course of routine practice.

The book is well printed on excellent stock and the illustrations are good. It is a volume that every practitioner should have in his library.

MEDICAL CONGRESS—CENTENARY OF URUGUAY

Among the various programs scheduled during the year of Uruguay's celebration of her completed century of national and political emancipation, the "Congress of Medical Science," taking place in October, was one of the interesting events.

Doctors of the many branches of medical science, from both North and South America, came to Uruguay to read reports and to demonstrate in clinics the results of the latest developments in medicine.

Not only did this Congress present the interesting scientific facts of the day, but it also showed the continuous and important prog-

ress made by the Americas, and proves their position to be strong in the branches of medical science represented, and their desire to better the conditions of life economically, physically, ethically and spiritually.

The section on odontology had brilliant sessions and elicited great interest and applause. Demonstrations were made in many cases, and the attendance was numerous (about 500 people at each session) and enthusiastic.

Dayton Dunbar Campbell of Kansas City, Mo., U. S. A., delivered a discourse on full dentures, explaining each step of the technic. Alejandro Osimani of Montevideo presented a film treating of the pathology and technic of the treatment for pyorrhea alveolaris. The film, which was made only 30 cm. from the mouth, showed the minutest details. It was received with warm applause and repeated by request.

FEDERATION DENTAIRE INTERNATIONALE (F.D.I.)

Hygiene Commission (H.C.F.D.I.)

The purpose of the following is an explanation of the aim and method of operation of the H.C.F.D.I. for the dental profession.

The Hygiene Commission particularly covers of the field of study of (1) mouth hygiene conditions in the various countries; (2) the influence of mouth and tooth diseases on health conditions at large, and (3) the means of improving mouth hygiene conditions by (*a*) the introduction of and propaganda regarding dental care, before, during and after compulsory school age, for the purpose of improving mouth conditions, (*b*) promoting dental care and mouth hygiene among the masses (adults) who because of their social economic position are deprived of this benefit, and (*c*) inquiring into means of preventing diseases of the teeth and mouth.

The Hygiene Commission therefore approaches the national committees affiliated with the F.D.I. for the purpose of collecting and getting acquainted with the most recent results of mouth hygiene measures and dental care, as well as of preventive work in any country.

The Hygiene Commission prompts inquiries in many countries and is able, by virtue of the reports received, to spread information in the domain of mouth hygiene and dental care. This information bears not only on installation, but also on the most economic application of the dental provisions for school children and adults (e.g., estimates of cost).

Furthermore, mention is made of the fact that during the annual session at Utrecht, it was resolved that the commission should collect and widely spread all means of enlightening the nations about mouth hygiene and dental care, to bring about the appreciation of effective dental care as a necessity by advancement and organization of yearly exhibitions.

In this way, the Hygiene Commission promotes mouth hygiene propaganda in all countries, organizes mouth hygiene exhibitions on as many occasions as possible during annual sessions of the F.D.I. in countries where the latter are being held, for instruction of the people, and further endeavors by every possible means to have these exhibitions held in the countries affiliated with the F.D.I. The commission also is endeavoring to establish a permanent collection and one as complete as possible.

The Hygiene Commission considers it its duty to inquire into the causes of disease and the means for preventing or combating it.

They have the following three subcommissions: (1) the subcommission for dental care of children: (*a*) infants, (*b*) school children, and (*c*) children above school age; (2) the subcommission on public dental care (adults), and (3) the subcommission for mouth hygiene investigations and an international mouth hygiene institute. These subcommissions are engaged on present-day problems of mouth hygiene. The international institute of mouth hygiene is affiliated with this commission.

The efforts of the H.C.F.D.I. have not been unsuccessful. Already, under Professor Jessen's leadership, the commission is arousing interest in dental care in many countries. Particularly, dental care has been introduced on a large scale by constant propaganda in numerous countries.

The H.C.F.D.I., since 1925, has entered into relations with the Hygiene Committee of the League of Nations, through the intermediary of their honorary president, N. M. Josephus Jitta, delegate of the Hygiene Committee of the League of Nations, a relation which has been continued by a delegation of the Red Cross Commission, with the result that the Hygiene Committee of the League of Nations during their session, March 5-8, adopted the following resolution:

"The Health Committee, realizing the importance of maintaining efforts against dental disease as vigorously as against other disease, expresses its desire to be kept informed of the work of the International Dental Federation."

The Executive Council in the F.D.I.'s session at Brussels in 1930 charged the presidents of the Commission on External Relations (late Red Cross Commission) and of the H.C.F.D.I. together, to maintain relations.

We are confident that, in this way, governments of countries affiliated with the League of Nations can consider the aims of the H.C.F.D.I. more than they have up to the present time (June, 1930).

Commission of the Red Cross

The commission which took charge of relations with the Red Cross was organized immediately after the war. This commission is the connecting link between the international organizations and one of the most important commissions of the F.D.I., the Hygiene Commission.

At Copenhagen, in 1927, the question arose as to whether the commission in connection with the Red Cross should be united with the Hygiene Commission, it being decided that the two commissions should work separately, which they have done, but with excellent collaboration.

The representatives of the F.D.I. quickly obtained tangible results. To quote but one: The Hygiene Committee of the League of Nations has decided to sustain morally the aim pursued by the F.D.I. The Hygiene Committee has decreed that "oral sepsis" shall be combated as energetically as other illnesses, and ask that all the work of the F.D.I. be communicated to the committee.

The kindness with which our commission was met by Dr. Humbert in Paris, director of the League of the Red Crosses, allows us to hope that the National Committee of the Red Cross will always be more and more interested in hygiene and oral prophylaxis. The Polish Red Cross, which has created five dental offices, ought to be an example to the other national organizations of the Red Cross.

We could say much more on the necessity of giving greater impetus to the action of the commission in connection with the Red Cross and the international organizations. The reader whom the topic interests can consult the work published in the Annual Report of the F.D.I., 1930, page 170: "The Red Cross, Its Relations with Oral Hygiene."

We hope that the help of several colleagues, in all the different nations, will permit the commission in connection with the Red Cross to accomplish its task.

At the session in Brussels in 1930, the Executive Council decided to place in charge of that commission the relations with the Red Cross and all other international organizations: the Hygiene Section of the League of Nations, the International Labor Office, and the Confederation of the Intellectual Workers. Important decisions have already been obtained.

René Jaccard,
Geneva.

CORRESPONDENCE

Early vs. Modern Dentures

To the Editor: Believing that it might be interesting to some of our young and modern dentists to draw from the dust-covered discard of the old time equipment and methods, for comparison with the new and up-to-date, I have plucked from the waste basket of experience a few specimens which I shall be pleased to donate to the archives of our profession.

In August, 1885, just after receiving a diploma from the University of Michigan, I opened an office for practice at Menomonie, Wis. One of my first operations was to make a full upper and lower denture. The H. D. Justi gum section teeth and S. S. White bow spring rubber were used. After seventeen years' wear, the lowers became too short from absorption of the ridge and I rebased them to restore length and contour. Nothing more has been done on either plate.

Last spring (1930) I made the wearer a new set of dentures in order to possess the old set for history. They have given constant service for forty-five years. I shall be pleased to hear from any member of our profession who can show a product of dental service which has endured for so many years.

The old-time dentist with little and crude appliances built gold fillings, crowns and bridges which are giving service to the wearer after forty or fifty years. The result of study and scientific inquiry into the mysteries of nature are marvelous, leading us to wonder, what next?

Service to patients should be one's constant ambition, and should lead one to contemplate

whether modern and easy methods will be as enduring as the best of the past.

W. H. Bailey,
Miami Shores, Fla.

NEWS

Eastern Society of Dental Anesthesia Meets: The second annual meeting of the Eastern Society of Dental Anesthesia was held at the Hotel Montclair, New York City, Friday night, January 9, when the following men were elected to office: P. F. Hildebrand, president; Charles Siegel, vice president; Herman Braun, secretary, and H. B. Rosenthal, treasurer.

Sudden Death of A. C. Lockett: A cable from London brings word of the sudden death of A. C. Lockett, secretary general of the Second International Orthodontic Congress. Communications relating to the congress are to be addressed to B. Maxwell Stephens, secretary general, 76 Grosvenor St., London, W 1, England.

Death of Dr. Conrad: William N. Conrad, St. Louis, Mo. (Western College of Dental Surgeons, 1879), died, January 9, at the age of 76, from injuries received in an automobile accident, December 30. Dr. Conrad was born in a covered wagon in an immigrant train crossing Nebraska on the way to California. He practiced dentistry for more than fifty years, retiring about two years ago. Dr. Conrad had been president of state and city dental societies and was a member of the committee of the Fourth International Dental Congress.

INTERNATIONAL NEWS

The following items of general interest appear in the news "Notes" in a recent issue of the *British Dental Journal:*

The International Congress of Military Medicine and Pharmacy in 1931: Many readers will remember the fourth International Congress of Military Medicine and Pharmacy in London last year, the dental section holding its meetings at the Association Headquarters. The next meeting is to take place at The Hague and not at Budapest as was previously arranged. The time selected, June 1 to 6, is suitable for several reasons, not the least being that it is an excellent season for visiting The Hague and its surroundings. Preparations are already being made for entertaining the delegates who will attend, and a special feature will be an exhibition exemplifying the sea, land and air sanitary services from the historical point of view. Five subjects are again allotted for discussion in the Congress, after introduction, usually by one representative each of Holland and another country. The last of these, "The After-Effects of War Injuries of the Teeth and the Lower Jaw, and Their Treatment," is to be presented by Holland and Poland.

Association Stomatologique Internationale: The International Congress of Stomatology, which was formed some years ago, has arranged to hold its next meetings at Budapest, from September 2 to 7, 1931, and will therefore be the third assembly of the kind of special interest to dental surgeons next year. On the last occasion, at Venice, Dr. Szabo was elected President and Dr. Sturm, General Secretary. Hungary has made important contributions to dental science, Dr. Arkovy having been amongst the best known of its workers in the specialty, and a representative gathering of Stomatologists may be expected to do honour to his memory.

Postgraduate Courses in Germany: This country is not by any means the only one to realise the importance of improving the quality of its postgraduate dental teaching. In Germany the Central-Verein Deutscher Zahnärzte announces that a plan has been formulated for a long-needed unification of dental postgraduate study courses, and it is recommended that a National Committee should be set up for this purpose, having as its model the Prussian Organization already in active operation. It is to have three main objects: (1) to draw up a scheme for study courses and demonstrations; (2) to make lists of suitable University lecturers willing to give the instruction, and to stimulate the organising of these courses in the various districts independently, or in conjunction with headquarters; (3) to supply the necessary equipment. The main object will be to afford the individual practitioners better opportunities for study of this kind at a comparatively small cost. At present, Prussia appears to be the only State of the Federation undertaking the work, although Baden and Saxony are making a State contribution for the purpose, which appears to be quite insufficient. The chief difficulty in the way of the scheme centres round the question whether both classes of dentists—the Zahnärzte and the technician—shall be entitled to attend, but, as the Central-Verein organ points out, the object is not to improve the financial position of the indivi-

dual practitioner, but to raise the standard of all for the good of the State.

—and in Russia: There is no question as to the communistic objects of the Russian system. Here continuation courses take place yearly, and dentists from every part of the Republic participate in them. Each department is obliged to send at least one practitioner for the course of four months' instruction. He is paid his usual salary during this time and receives travelling and other out-of-pocket expenses, but after his return he has to impart the theoretical and practical knowledge he has acquired to his local colleagues, who, in their turn, are presumably bound to take advantage of his ministrations. It is anticipated that this system will shortly be supplemented by an arrangement of itinerant lecturers.

Refusals of Dental Treatment in Schools: The elementary school children of America for whom dental treatment is refused are likely to become unpopular with their classmates if one of the proposals of the Commonwealth Fund for Child Health is carried into general effect. How far the offer of a holiday to classes securing 100 per cent corrections of dental defects would be taken advantage of in the United States we do not know, but it seems probable that the plan might be adopted by local education authorities in this country, without any serious reduction, for some time to come, in the hours devoted to study. More frequent inspections, and consequent increases in the school dental staffs, would apparently be required, before such a scheme could be entertained by most of the committees.

Retirement of Professor Gysi: We learn that Professor Gysi has retired from the chair of dentistry at the University of Zurich which he has held for many years. Professor Gysi is one of the select band who have attained an international reputation in the dental profession. His contributions to dental prosthesis have proved of great value and the articulator which bears his name is widely used. Professor Gysi will carry with him into his retirement the good wishes of the dental profession in all countries.

ASSOCIATION NEWS

OUR NEW HOME

There has been an increasing demand and need for services and new activities which have necessitated the enlargement of the quarters occupied by the American Dental Association. The men in close contact with the situation have recognized the necessity for this expansion and could also see that there would be a demand for additional space in the future. It was only natural that they should also think of the possibility and desirability of purchasing a permanent location on which the Association could establish itself in a manner befitting its position.

The expiration of the present lease made it necessary that the Board of Trustees consider the question of future quarters. This was brought up at the regular meeting held during the Annual Session at Denver and placed before the House of Delegates, who granted authority to lease or purchase suitable space for the Association.

A number of renting possibilities were investigated, and between thirty or forty parcels of property were considered from the point of view of purchasing. It became apparent that there was one piece of property which was an outstandingly desirable purchase. A meeting of the Ad Interim Committee of the Board of Trustees was called to investigate the proposition thoroughly, and after consideration of the following questions, it was decided to recommend the purchase.

1. *Location.*—The property is located at 212 East Superior Street, within a block of the downtown campus of Northwestern University. It is a block east of Michigan Avenue and is in a locality which is good at present and has excellent possibilities for the future.

2. *Building.*—The building is a well-constructed, four-story structure in a good state of repair, with a one-story attached building in the rear. It affords an additional 2,000 square feet of usable floor space as compared with our present quarters, which will allow for the installation of a laboratory and expansion of the library and other activities.

3. *Cost of Operation.*—The total expense for interest, taxes, insurance, heat, a caretaker and a liberal allowance for repairs and maintenance does not equal the present rent payment. The rental charge for the much needed space for a laboratory at the rates prevailing would approximate $3,000 a year. It is possible to make this saving under the present plan, to say nothing of the value to the Association of being established in its own building.

4. *Value.*—Various checks were made to ascertain the value of the property. One of the large reliable banks was requested to value the property as if it were vacant. The purchase price of the land and building was under this valuation. Reports obtained from other sources made it apparent that this property was priced very advantageously even in the present low market and therefore offered an exceptional opportunity.

Some superficial alterations will be required. The larger amount of this work will be on the first floor, in order to use the available space to the best advantage. The installation of the laboratory for the Bureau of Chemistry on the fourth floor will necessitate some changes and connections, while the second and third floors can be occupied quite advantageously just as they are.

It was found to be more economical to continue in the present quarters as the lease does not expire until the spring. There is also the necessity of getting the premises in shape for occupancy, which will take considerable time. Definite plans are well under way and more details will be furnished later.

A. D. A. Group Insurance

The number of members who were insured under the A. D. A. Group Insurance, Dec. 1, 1930, totaled 8,986. During the month of November, eight claims were paid, amounting to $20,000, which makes the total number of claims paid to December 1, forty-eight, and the total amount paid, $124,000.

State Society Officers' Conference

The Conference of State Society Officers will be held in our new home, 212 East Superior Street, Feb. 1, 1931, at 9:30 a. m.

The office of the American Dental Association will not be moved to the new location until May 1, 1931.

Relief Fund Receipts

Contributions to the Relief Fund, to date, exceed those of any previous year, the total amount received as of December 30 being $14,561.56.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Memphis, Tenn., Oct. 19-23, 1931.

American Board of Orthodontia, St. Louis, Mo., April 20, 1930.

American Dental Hygienists' Association, Memphis, Tenn., Oct. 19-23, 1931.

American Dental Society of Europe, Paris, France, July 29-August 1, 1931.

American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

International Association of Dental Research, Memphis, Tenn., March 23-26, 1931.

International Dental Congress, Paris, France, Aug. 3-8, 1931.

International Orthodontic Congress, London, July 20-24, 1931.

International Stomatologic Congress, Budapest, Sept. 2-7, 1931.

Chicago Dental Society Midwinter Clinic, February 2-5.

Central Pennsylvania Dental Society, Johnstown, March 2-4.

Committee on Costs of Medical Care, Washington, D. C., September 17-24.

Dallas Midwinter Clinic, February 16-18.

Great Lakes Association of Orthodontists, Toledo, Ohio, Feb. 16-17.

Kings County Midyear Meeting, Brooklyn, N. Y., February 25-28.

New York Society of Orthodontists, New York City, March 11.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

St. Louis Study Club of Dentistry, March 25.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Academy of Periodontology, Atlanta, Ga., March 9.

University of Buffalo Dental Alumni Association, Buffalo, February 25-27.

March

Minnesota, at Minneapolis (4-6).

April

Alabama, at Mobile (14-16).
California State, at San Francisco (8-10).
Connecticut, at Hartford (28-30).
Kansas, at Hutchinson (27-29).
Kentucky, at Lexington (6-8).
Louisiana, at New Orleans (23-25).
Michigan, at Detroit (27-29).
Montana, at Helena (16-18).
New Jersey, at Atlantic City (15-17).
Oklahoma, at Oklahoma City (21-23).
Tennessee, at Nashville (21-24).

May

Illinois, at Peoria (12-14).
Indiana, at Indianapolis (18-20).
Iowa, at Des Moines (5-7).
Maryland, at Baltimore (4-6).
Massachusetts, at Boston (4-7).
Missouri, at Kansas City (25-29).
Nebraska, at Omaha (18-21).
New York, at New York City (12-15).
North Carolina, at Winston-Salem (4-6).
North Dakota, at Fargo (12-14).
Pennsylvania, at Pittsburgh (5-7).
South Carolina, at Columbia (7-8).
South Dakota, at Huron (11-12).
Texas, at Houston (12-15).
Vermont, at Burlington (20-22).
Virginia, at Old Point Comfort (11-13).
West Virginia, at Huntington (18-20).

June

Arkansas, at Little Rock (1-3).
California Southern, at Los Angeles (8-13).
Georgia, at Atlanta (10-12).
Maine, at South Poland (18-20).

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Nevada, at Reno (6).
Oregon, at Portland (17-20).
Washington, at Bellingham (June 30-July 1).
Wisconsin, at Milwaukee (9-11).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Illinois, at Chicago, February 2-3. Address Dental Division, Department of Registration, Springfield.

Indiana, at Indianapolis, June 15. J. M. Hale, Secretary, Mt. Vernon.

Kentucky, at Louisville, June 5-10. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

Maine, at Augusta, June 22-24. Alton H. Swett, Secretary, 192 State St., Portland.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana State Board of Dental Examiners will meet June 15, 8 a. m., at the State House, Indianapolis, in the House of Representatives Room, for the purpose of conducting an examination of all applicants for licensure in Indiana who come with proper credentials, and are accepted for examination. All applications should be in the hands of the secretary one week before the board meeting. The examination will probably last four days. For applications, clinical requirements and other information, address

J. M. HALE, *Sec'y-Treas.*,
Mt. Vernon.

NEW YORK SOCIETY OF ORTHODONTISTS

The annual meeting of the New York Society of Orthodonists will be held at the Hotel Commodore, Wednesday, March 11. The session will begin at 9:30 a. m. and continue all day. Physicians and dentists are invited.

WILLIAM C. FISHER, *President*,
LOWRIE J. PORTER, *Sec'y-Treas.*,
730 Fifth Ave., New York City.

MISSOURI STATE DENTAL SOCIETY (Change of Dates)

The Missouri State Dental Society will meet May 25-29, at Kansas City.

C. W. DIGGES, *Secretary*,
Columbia.

COMMITTEE ON COSTS OF MEDICAL CARE

A conference of the Committee on the Costs of Medical Care will be held September 17-24, at Washington, D. C.

HARRY H. MOORE.

TEXAS STATE DENTAL SOCIETY

The Texas State Dental Society will hold its fifty-first annual convention at Houston, May 12-15. An invitation to attend is extended to all dentists who are members of the American Dental Association. For information relative to exhibits address E. A. Morris, 1518 Medical Arts Bldg., Houston.

TOM F. COYLE, *President*,
Orange.
J. G. FIFE, *Sec'y-Treas.*,
Medical Arts Bldg.,
Dallas.

PENNSYLVANIA STATE DENTAL SOCIETY

The Pennsylvania State Dental Society will hold its sixty-third annual meeting at the William Penn Hotel, Pittsburgh, May 5-7. An invitation is extended to all members of the American Dental Association.

W. HARRY ARCHER, *Chairman*,
Publicity Committee,
322 Jenkins Arcade,
Pittsburgh.

GREAT LAKES ASSOCIATION OF ORTHODONTISTS

The Great Lakes Association of Orthodontists will hold its next meeting in Toledo, Ohio, February 16-17, at the Commodore Perry Hotel. An invitation is extended to the dental profession.

E. N. BACH, *President*,
1307 Second National Bank Bldg.,
Toledo, Ohio.
S. A. MACKENZIE, *Sec'y-Treas.*,
1011 Stroh Bldg.,
Detroit, Mich.

SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The Society for the Advancement of General Anesthesia in Dentistry will hold its next

meeting at the Barbizon-Plaza, Fifty-Eighth St. and Sixth Ave., Monday evening, February 16. Dinner is at 7 p. m., $3 a plate. The scientific session starts at 8 p. m. Aaron E. Parsonnet, M.D., will speak on "The Heart During Anesthesia." Membership in this society is open to all ethical practitioners and correspondence is invited. Meetings are held on the third Monday in February, April, October and December, in New York City.

M. HILLEL FELDMAN, *President,*
730 Fifth Ave.,
New York City.

LEONARD MORVAY, *Secretary,*
76 Clinton Ave.,
Newark, N. J.

JAMES T. GWATHMEY (M.D.),
Honorary President,
30 W. Sixty-Ninth St.,
New York City.

LOUISIANA STATE DENTAL SOCIETY

(Change of Dates)

The next meeting of the Louisiana State Dental Society will be held April 23-25, at New Orleans.

JULIAN S. BERNHARD, *Secretary.*

MAINE BOARD OF DENTAL EXAMINERS

The next meeting of the Maine Board of Dental Examiners will be held at the State House, Augusta, June 22-24. For applications and further information, address

ALTON H. SWETT, *Secretary,*
192 State St.,
Portland.

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION

The thirty-first annual meeting of the University of Buffalo Dental Alumni Association will be held at the Hotel Statler, Buffalo, February 25-27. Among the essayists will be George B. Winters, Rupert E. Hall and Norman E. Denner. An invitation is extended to the dental profession.

RUSSELL W. GROH, *Secretary,*
138 Highland Ave.,
Buffalo.

NEW JERSEY STATE DENTAL SOCIETY

The sixty-first annual session of the New Jersey State Dental Society will be held April 15-17, at the Hotel Chelsea, Atlantic City. For information concerning exhibits, address E. J. H. Schneider, director, 806 Clinton Ave., Newark. Clinical data may be secured from Eugene W. Roberts, chairman of the clinic committee, 657 Haddon Ave., Collingswood.

GEORGE H. MARTIN, *President,*
921 Bergen Ave.,
Jersey City.

F. K. HEAZELTON, *Secretary,*
223 East Hanover St.,
Trenton.

OREGON STATE DENTAL ASSOCIATION

The thirty-eighth annual session of the Oregon State Dental Association will be held in Portland, June 17-20, at the Northwest Pacific College.

F. W. HOLLISTER, *Secretary.*

SOUTH CAROLINA STATE DENTAL ASSOCIATION

The sixty-first annual meeting of the South Carolina State Dental Association will be held in Columbia, May 7-8.

N. W. MACAULAY, *Secretary,*
Medical Bldg.,
Columbia.

ST. LOUIS STUDY CLUB OF DENTISTRY

The thirteenth annual clinic of the St. Louis Study Club of Dentistry will be held Wednesday afternoon, March 25, from 3 to 5:30 p. m., at the Forest Park Hotel, 4910 West Pine Blvd. A dinner will be given at 6:30 p. m. as a tribute to the instructors by the students. A cordial invitation is extended to all ethical members of the profession to attend. Bulletins descriptive of the study club may be had by addressing

A. C. MOGLER, *President,*
4482 Washington Blvd.,
St. Louis.

SOUTHERN ACADEMY OF PERIODONTOLOGY

The eleventh meeting of the Southern Academy of Periodontology will be held in

Atlanta, Ga., March 9. Harold J. Leonard, of New York City, will present a paper on "Constitutional Factors in the Etiology of Periodontoclasia," and a clinic on "Gingivo-periodontal Symptoms of Periodontal Conditions."

CHARLES W. YOUNG, *President,*
Candler Bldg.,
Atlanta, Ga.
JOHN V. PIERSON, *Secretary,*
Medical Arts Bldg.,
Atlanta, Ga.

THE AMERICAN BOARD OF ORTHODONTIA

(Created by the American Society of Orthodontists, 1929; incorporated, January, 1930, State of Illinois, U. S. A.)

A meeting of the American Board of Orthodontia will be held at Hotel Jefferson, St. Louis, Mo., April 20, at 9 a. m. Those orthodontists who desire to qualify for a certificate from the board should secure the necessary application form from the Secretary. Attention is called to the following resolutions adopted by the board: Any person desiring to make application to the board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the board and based upon the following conditions: (1) an instructor in orthodontia in a school satisfactory to the board; (2) an associate in the office of an orthodontist whose standing is satisfactory to the board. It is to be definitely understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

ALBERT H. KETCHEM, *President,*
1232 Republic Bldg.,
Denver, Colo.
OREN A. OLIVER, *Secretary,*
1101 Medical Arts Bldg.,
Nashville, Tenn.

AMERICAN HOME ECONOMICS ASSOCIATION

The twenty-fourth annual meeting of the American Home Economics Association will be held in Detroit, Mich., June 22-27. Information regarding hotels, railroad rates, etc., will be given in the April issue of the association bulletin and in the *Journal of Home Economics.* The preliminary program will be printed in the May bulletin.

IMPOSTER

Dentists are warned to beware of a man representing himself to be a salesman for the King Shirt Shop of Cincinnati, Ohio, and giving the name J. E. King (owner), address 1442 Central Ave. He has gray hair, looks to be about 60, and is about 5 feet 6 inches tall. Inquiry of the police department of Cincinnati by a dentist who was victimized revealed that there is no such shop and no such street number in Cincinnati.

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1930-1931

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